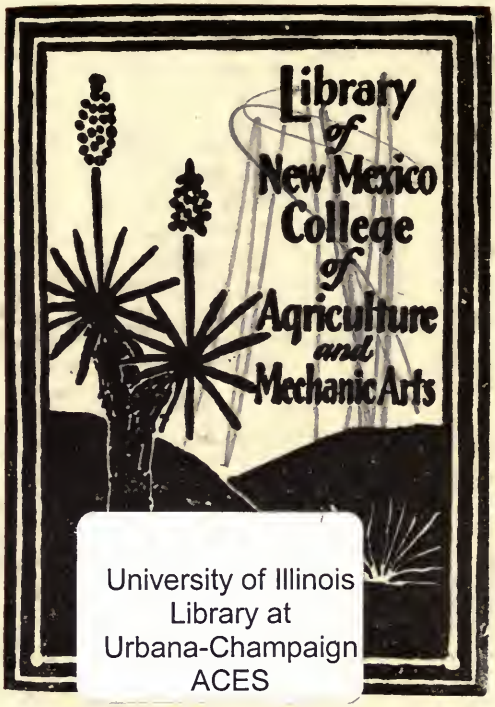


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# THE FERTILITY IN ILLINOIS SOILS

By CYRIL G. HOPKINS, Chief in Agronomy and Chemistry, and JAMES H. PETTIT, Assistant Chief in Soil Fertility

"Westward the course of empire takes its way," with ruined lands behind.

The purpose of the six years' work represented in this bulletin is to furnish definite facts and necessary information to Illinois landowners and farmers that will enable them to plan and adopt systems of farming under which the soils of Illinois will be certain to continue, or improve, in productive power instead of decreasing in fertility as they are doing under the most common present practices.

While the bulletin deals primarily with the invoice of plant food in the most important Illinois soils found in a general soil survey of the state, its value is greatly increased and strengthened because of the large amount of definite information concerning the numerous soil types already accumulated in connection with the detail soil survey which is being conducted under the immediate charge of Professor J. G. Mosier with a corps of able assistants; also by the numerous results already obtained from the soil experiments which are carried on in many parts of the state on representative fields in charge of Superintendent J. E. Readhimer and his assistants.

But the absolute basis of these investigations rests upon chemical analysis, and especial acknowledgments are made to the following chemists upon whose chemical knowledge and analytical skill the accuracy of the work depends: Professor I. O. Schaub, now at the Iowa Station; Doctor E. M. East, now at the Connecticut Station; Mr. W. F. Pate, now at the Ohio Station; Mr. Andrew Ystgard, deceased; Mr. N. E. Bell, now at the Alabama Station; and Doctor L. H. Smith, A. W. Gregory, and E. VanAlstine, who continue in the service of Illinois.

## Plan of Investigation

In the investigation of the fertility of the soil in its relation to crop production five general questions must be considered.

1. What are the plant food requirements of the crops to be produced?

2. What is the total stock of plant food contained in the soil strata which we are able to control?

3. How rapidly by practical methods can this plant food be made available to the growing crops?

4. When necessary, in order to produce more profitable crop yields, how can we most economically supplement or increase the plant food in the soil?

5. Under what systems will the productive power of the soil be *permanently* maintained?

## PLANT FOOD REQUIRED BY CROPS

It should be remembered that of the ten different chemical elements required for the growth of agricultural plants, three come directly from air and water in practically unlimited amounts (except in time of drouth), and that these three, carbon, hydrogen, and oxygen, constitute, as a rule about 95 percent of the mature crop. Nevertheless each of the seven elements obtained from the soil, though aggregating only 5 percent, is just as necessary to the life and full development of the plant, as are these three.

The four elements, sulfur, calcium, iron, and magnesium, are required by crops in such small amounts and are present in nearly all soils in such large amounts that the supply rarely if ever becomes depleted, thus narrowing the problem essentially to three elements, constituting not more than 4 percent of the average crop.

The productive capacity of practically all soils in good physical condition is measured by the available supply of the three plant food elements, phosphorus, potassium, and nitrogen, because they are required by all crops in very considerable quantities, while in most soils the supply of one or more of them is limited. If the supply of one of these elements is too limited, it must as a consequence, limit the yield of the crop, even though all other factors essential to crop production are well provided. It is because of these facts that the three elements, phosphorus, potassium, and nitrogen, in commercial form, have come to have a recgnized money value.

A careful study of Table 1 is sufficient to make the reader familiar with the plant food requirements of the more important Illinois crops. Information is also given regarding the amounts of these valuable elements contained in the different parts of the crop, as grain, stalks, and straw, and in some animal products, in order that it may be known with some degree of accuracy how much of each element is removed from the soil in crops and how much is sold from the farm in different kinds of farm produce. The ideal practice is to return to the soil in farm manures all plant food not sold from the farm.

The data given in Table 1 are on the basis of pounds per acre for crop yields which are large, but which, when the best conditions are furnished, have been and may be produced with very great profit—yields that may well stand as an ideal, desirable and possible to be attained.

Of course, approximately proportionate amounts would be required for any other yields. Thus, if it is preferred to plan to make possible yields only one-half as large, then the amounts given may be divided by two.

TABLE 1.—FERTILITY IN FARM PRODUCE
(Approximate maximum amounts removable per acre annually)

| Produce. | | Pounds. | | | Market value. | | | |
|---|---|---|---|---|---|---|---|---|
| Kind. | Amount. | Nitrogen. | Phosphorus. | Potassium. | Nitrogen. | Phosphorus. | Potassium. | Total value. |
| Corn, grain ... | 100 bu. | 100 | 17 | 19 | $15.00 | $ 2.04 | $ 1.14 | $18 18 |
| Corn stover... | 3 T. | 48 | 6 | 52 | 7.20 | .72 | 3.12 | 11.04 |
| Corn crop..... | | 148 | 23 | 71 | 22.20 | 2.76 | 4.26 | 29.22 |
| Oats, grain ... | 100 bu. | 66 | 11 | 16 | 9.90 | 1.32 | .96 | 12.18 |
| Oat straw..... | 2½ T. | 31 | 5 | 52 | 4.65 | .60 | 3 12 | 8.37 |
| Oat crop..... | | 97 | 16 | 68 | 14.55 | 1.92 | 4.08 | 20.55 |
| Wheat, grain . | 50 bu | 71 | 12 | 13 | 10.65 | 1.44 | .78 | 12.87 |
| Wheat straw.. | 2½ T. | 25 | 4 | 35 | 3.75 | .48 | 2.10 | 6.33 |
| Wheat crop... | | 96 | 16 | 48 | 14.40 | 1.92 | 2.88 | 19.20 |
| Timothy hay.. | 3 T. | 72 | 9 | 71 | 10.80 | 1.08 | 4.26 | 16.14 |
| Clover seed.... | 4 bu. | 7 | 2 | 3 | 1.05 | .24 | .18 | 1.47 |
| Clover hay.... | 4 T. | 160 | 20 | 120 | 24.00 | 2.40 | 7.20 | 33.60 |
| Cowpea hay... | 3 T. | 130 | 14 | 98 | 19.50 | 1.68 | 5.88 | 27.06 |
| Alfalfa hay.... | 8 T. | 400 | 36 | 192 | 60.00 | 4.32 | 11.52 | 75.84 |
| Apples..... | 600 bu. | 47 | 5 | 57 | 7.05 | .60 | 3.42 | 11.07 |
| Leaves..... | 4 T. | 59 | 7 | 47 | 8.85 | .84 | 2.82 | 12.51 |
| Wood growth. | 1/50 tree | 6 | 2 | 5 | .90 | .24 | .30 | 1.44 |
| Total crop .... | | 112 | 14 | 109 | 16.80 | 1.68 | 6.54 | 25.02 |
| Potatoes..... | 300 bu. | 63 | 13 | 90 | 9.45 | 1.56 | 5.40 | 16.41 |
| Sugar beets... | 20 T. | 100 | 18 | 157 | 15.00 | 2.16 | 9.42 | 26.58 |
| Fat cattle..... | 1,000 lb. | 25 | 7 | 1 | 3.75 | .84 | .06 | 4.65 |
| Fat hogs..... | 1,000 lb. | 18 | 3 | 1 | 2.70 | .36 | .06 | 3.12 |
| Milk..... | 10,000 lb. | 57 | 7 | 12 | 8.55 | .84 | .72 | 10.11 |
| Butter..... | 500 lb. | 1 | 0.2 | 0.1 | .15 | .02 | 0.1 | .18 |

The value of the elements is computed on the basis of the present market prices for readily available plant food, namely:

Nitrogen.....15 cents a pound
Phosphorus.....12 cents a pound
Potassium..... 6 cents a pound

It may be said that other similar crops resemble somewhat closely those given in Table 1 as to plant food requirements. Thus rye and barley are not markedly different in requirements from wheat and oats, considering equal yields in pounds of grain and straw. Other root crops may be compared with sugar beets, other grasses with timothy, hay from other annual legumes with cowpea hay, and other biennial and perennial legumes may be compared in a general way with red clover and alfalfa.

The figures given in Table 1 are based upon averages of many analyses, of which some have been made by the Illinois Station and others by various chemists in America and Europe. These averages are believed to be trustworthy for large crops of good quality. Abnormal or special crops may vary considerably from these averages. Thus we have high-protein corn and low-protein corn, one strain requiring nearly twice as much nitrogen and somewhat more phosphorus than the other; and we have shown in Bulletins 76 and 94 that alfalfa and cowpeas are not only much more productive but much richer in nitrogen when grown on Illinois soils with the proper bacteria than without bacteria.

TABLE 2.—FERTILITY IN MANURE, ROUGH FEEDS, AND FERTILIZERS

| Name of material. | Pounds per ton. | | | Value per ton. | | | |
|---|---|---|---|---|---|---|---|
| | Nitrogen. | Phosphorus. | Potassium. | Nitrogen. | Phosphorus. | Potassium. | Total value. |
| Fresh farm manure | 10 | 2 | 10 | $1.50 | $ .24 | $ .60 | $2.34 |
| Corn stover | 16 | 2 | 17 | 2.40 | .24 | 1.02 | 3.66 |
| Oat straw | 12 | 2 | 21 | 1.80 | .24 | 1.26 | 3.30 |
| Wheat straw | 10 | 2 | 14 | 1.50 | .24 | .84 | 2 58 |
| Clover hay | 40 | 5 | 30 | 6.00 | .60 | 1.80 | 8.40 |
| Cowpea hay | 43 | 5 | 33 | 6.45 | .60 | 1.98 | 9.03 |
| Alfalfa hay | 50 | 4 | 24 | 7.50 | .48 | 1.44 | 9.42 |
| Dried blood | 280 | | | 42.00 | | | 42.00 |
| Sodium nitrate | 310 | | | 46.50 | | | 46.50 |
| Ammonium sulfate | 400 | | | 60.00 | | | 60.00 |
| Raw bone meal | 80 | 180 | | 12.00 | 18.00 | | 30.00 |
| Steamed bone meal | 20 | 250 | | 3.00 | 25.00 | | 28.00 |
| Raw rock phosphate | | 250 | | | 10.00 | | 10.00 |
| Acid phosphate | | 125 | | | 15.00 | | 15.00 |
| Potassium chlorid | | | 850 | | | 51.00 | 51.00 |
| Potassium sulfate | | | 850 | | | 51.00 | 51.00 |
| Kainit | | | 200 | | | 12.00 | 12.00 |
| Wood ashes* | | 10 | 100 | | 1.20 | 6.00 | 7.20 |

*Wood ashes also contain about 1000 pounds of lime (calcium carbonate) per ton.

## SOURCES OF PLANT FOOD

If the productive capacity of Illinois soils is to be maintained elements of plant food which are present in such small amounts as to limit crop yields even under good systems of farming must be returned to the soil as needed, and information is given in Table 2 to show the average quantities in pounds of the different valuable elements of plant food contained in one ton of average fresh farm manure, rough feeds and bedding, and other fertilizer materials.

In computing the value of the plant food in these materials, nitrogen is counted at 15 cents a pound and potassium at 6 cents a pound; while phosphorus is counted at 4 cents a pound in raw rock phosphate, at 10 cents a pound in bone meal, and at 12 cents a pound in acid phosphate, these prices being based upon average market values for the standard fertilizing materials in small lots. In carload lots lower prices may be secured.

The information contained in Table 1 and Table 2 will be found of value in connection with a study of the composition of Illinois soils shown in Table 3, especially in planning systems for the improvement and permanent maintenance of the different types of soil, containing varying amounts of these plant food elements.

Thus, it should be plain to see that to supply the plant food for a four-year rotation consisting of corn for two years, followed by oats with clover seeding the third year, and clover hay and seed crops the fourth year, assuming the yields given in Table 1, would require an application of 39 tons of manure to supply the nitrogen, 41 tons to supply the phosphorus, or 33 tons to supply the potassium, assuming that the clover secures from the air sufficient nitrogen for the clover crops removed. In making computations of this sort it is safe to assume that the clover takes at least as much nitrogen from good soil as remains in the clover roots and stubble. It should also be understood that there will be a very considerable loss of nitrogen in drainage waters, which may easily amount to one-third of the nitrogen applied if the land is much exposed without cover crops.

It should be kept in mind that it becomes much easier to maintain the supply of nitrogen if some clover is plowed under and if the rotation is extended to include two or three years of pasture with a mixture of legumes and grasses, as red clover, alsike, alfalfa, timothy, and red top. If the supply of manure is sufficient to furnish only 12 tons of manure per acre once in four years, it may still be possible to maintain the supply of nitrogen and humus by supplementing the manure with legume crops and catch crops grown in the rotation and in pasture, but in such case it is plain to see that

while the crops remove 82 pounds of phosphorus from an acre the 12 tons of manure return only 24 pounds of that element, leaving a deficiency of 58 pounds, which, however, can be made up by applying with the manure a few hundred pounds of raw rock phosphate, about 50 pounds of phosphate with each load of manure being ample to maintain the phosphorus content of the soil, larger amounts being used if it is desired gradually to increase the supply of phosphorus in the soil. It will be observed that one ton of rock phosphate contains more phosphorus than 100 tons of average fresh farm manure.

If the soil is exceedingly rich in potassium, as it will be shown is the case with most Illinois soils, then no further consideration need be given to that element, except to insure its liberation by the action of decaying organic matter, the supply of which will be maintained by following the suggestions for maintaining the supply of nitrogen. On the other hand with soils exceedingly deficient in potassium, as with certain peaty swamp lands whose composition is shown in Table 3, that element may well be supplied in some concentrated potassium salt, such as potassium chlorid (sometimes incorrectly called "muriate of potash"), one ton of which contains as much potassium as 85 tons of average fresh farm manure.

If the soil is markedly sour, or acid, of course the acidity should be corrected with an application of some form of lime, ground limestone being the most economical and satisfactory form to use as a rule.

In case the total supply of potassium in the soil is very large but the supply of decaying organic matter so small that applications of soluble potassium salts produce marked increase in crop yields, as shown, for example, on the prairie lands of southern Illinois described in the following pages, it should be understood that the effect is produced not entirely by the element potassium but in part at least by the stimulating action of the soluble salt, and that instead of using a high-priced concentrated potassium salt, as would be best to supply potassium for peaty swamp land, it will be less expensive and more profitable to use on southern Illinois soil such a low-priced *mixture* of soluble salts as kainit, which contains nearly 25 percent of potassium sulfate, about 16 percent of magnesium sulfate, 12 percent of magnesium chlorid, and 33 percent of sodium chlorid (common salt), together with about 14 percent of combined water.

For more complete discussion of the use of limestone, Illinois readers are referred to Circular 110, "Ground Limestone for Acid Soils."

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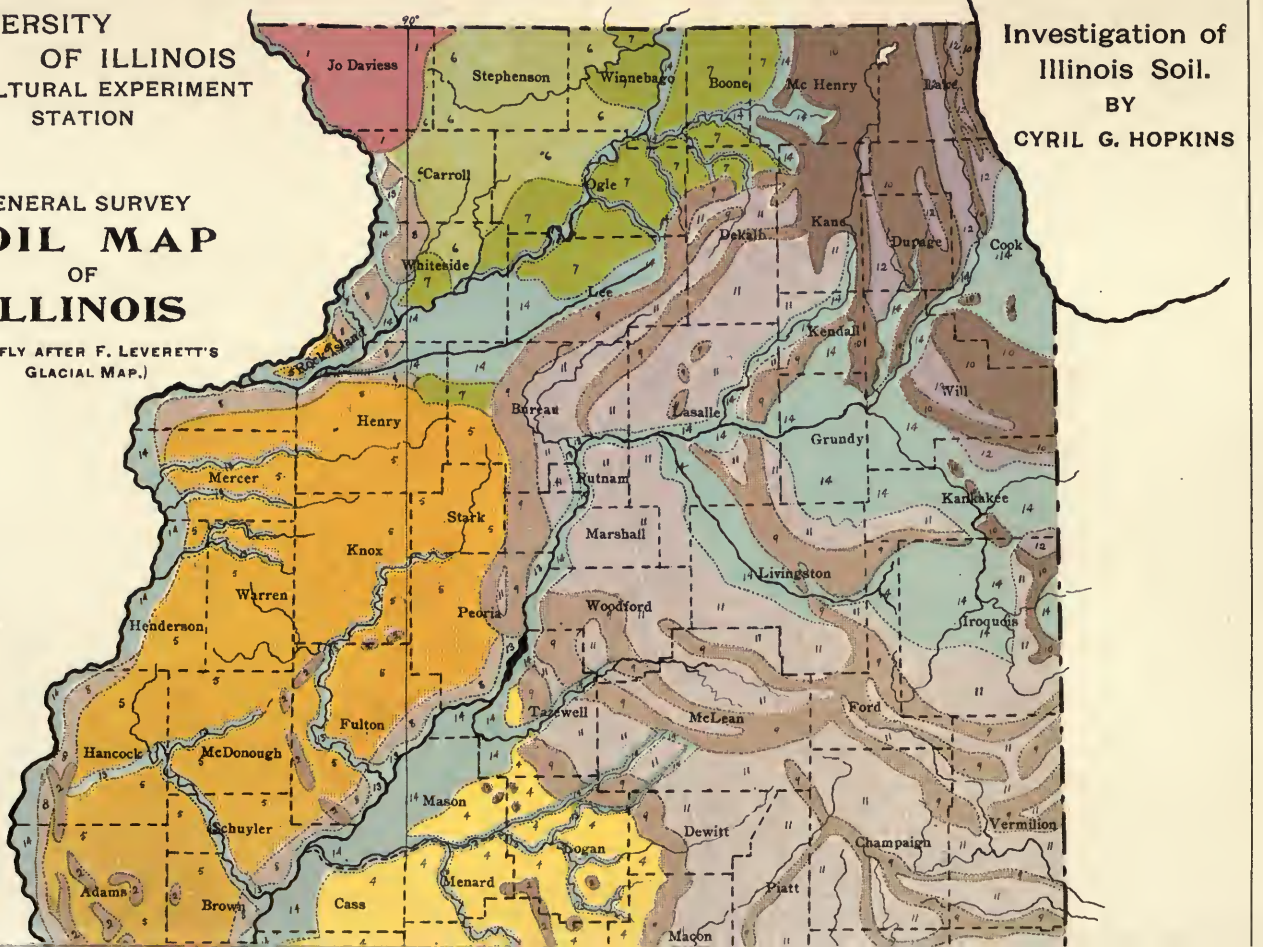
GENERAL SURVEY

# SOIL MAP
OF
# ILLINOIS

(CHIEFLY AFTER F. LEVERETT'S
GLACIAL MAP.)

Investigation of
Illinois Soil.
BY
CYRIL G. HOPKINS



1 Unglaciated areas.
2 Illinoisan moraines (In Illinoisan glaciation).
3 Lower Illinoisan glaciation.
4 Middle Illinoisan glaciation.
5 Upper Illinoisan glaciation.
6 Pre-Iowan glaciation.
7 Iowan glaciation.
8 Deep loess areas
9 Early Wisconsin moraines (in early Wisconsin glaciation)
10 Late Wisconsin moraines (in late Wisconsin glaciation)
11 Early Wisconsin glaciation
12 Late Wisconsin glaciation
13 Old river bottom and swamp areas
14 Sand, late swamp and bottom lands.
Sangamon
Moultrie
Edgar
Pike
Scott
Coles
Christian
Shelby
Clark
Greene
Macoupin
Montgomery
Cumberland
Calhoun
Jersey
Fayette
Effingham
Jasper
Crawford
Bond
Madison
Clay
Lawrence
Richland
Marion
Clinton
St. Clair
Wayne
Wabash
Edwards
Washington
Monroe
Jefferson
Randolph
Perry
Hamilton
White
Franklin
90°
Jackson
Williamson
Saline
Gallatin
Union
Johnson
Pope
Hardin
Alexander
Pulaski
Massac

## ILLINOIS SOIL AREAS AND SOIL TYPES

According to geological investigation there have been at least three different periods when glaciers, or ice sheets, have covered more or less of the State of Illinois, in consequence of which nearly all of the surface of the state has been covered with drift, or glacial material, which is termed till, or bowlder clay, and is characterized by the presence of more or less coarse material varying in size from pebbles to bowlders, imbedded in clay, the materials having been gathered by the ice sheets as they slowly flowed over the surface of the earth. In the process of transportation much of the drift became finely ground so that when finally deposited the till consisted of material varying in size from clay to bowlders. Where for a long period of time the forward movement of the glacier was practically equalled by the rapidity with which the ice melted, much material was deposited, forming what are termed moraines, or glacial ridges, varying in width from less than a mile to several miles, and extending around the lobe of the glaciated area sometimes for a distance of a hundred miles or more.

Generally the glacial till was covered finally by a layer of loess, which is a fine material that was transported by the action of wind or flowing water, probably from deposits of exposed till before it was protected by vegetation (and to some extent from the melting or evaporating glaciers), and deposited over the state to an average depth of three feet or less in some areas (as in the Late Wisconsin glaciation), and to eight or ten feet in others (as in the Upper Illinoisan and Pre-Iowan glaciations); while in the "Deep Loess" areas covering the bluff lands along some of the large streams the depth of the loessial material may be from twenty to one hundred feet.

The accompanying general survey soil map shows the areas that have been covered by the different glaciers, also the Unglaciated and Deep Loess areas and the general distribution of the early and late bottom lands and swamp areas, in which the soils vary from heavy clays or clay loams to peat beds on the one hand or to sand plains or drifting dunes on the other.

The first glacier may have covered all of Illinois as far south as the Ozark Hills (near the south line of Williamson county) excepting a part of Pike and Calhoun counties and an elevated area in the northwest corner of the state. The area where the drift from this first glacier has not been covered by a subsequent glacier is called the Illinoisan glaciation. For our purpose we divide this Illinoisan glaciation into three areas because of difference in the agricultural values and properties of the most common soils in these

sections (especially marked between the Lower and Middle Illinoisan glaciations). These three areas we call the Lower Illinoisan glaciation (No. 3), the Middle Illinoisan glaciation (No. 4), and the Upper Illinoisan glaciation (No. 5), each of which will be more fully described later.

The second glacier extended only over three or four tiers of counties from the north line of the state, not including JoDaviess county. On the area where the drift from this second glacier has not been covered by a later glacier we have accepted the two divisions *recognized by geologists, one of which (No. 6) we call the Pre-Iowan glaciation, and the other (No. 7) the Iowan glaciation.

The third and last glacier covered approximately the northeast one-quarter part of the state, and this area is called the Wisconsin glaciation. This is divided into two areas, the early Wisconsin glaciation (Nos. 9 and 11) and the late Wisconsin glaciation (Nos. 10 and 12).

According to formation we recognize fourteen large soil areas in the state, although some formations are scattered in separated tracts and each of the fourteen areas may contain several or many different types of soil.

In studying soil types we consider the time and method of formation; the topography as affecting surface drainage and surface washing; the texture, varying from light, loose, or friable to heavy, compact, or plastic; the structure, especially with reference to uniformity or differences of the soil strata at different depths; and we also recognize, of course, the different materials of which soils are composed, as organic matter, clay, silt, sand, gravel, and stone. In naming a soil type we try to indicate (1) the great soil area in which it is found (2) the color of the soil, (3) the chief material of which it is composed (as clay, silt, sand, etc.) and sometimes (4) the topography. Sometimes the name also indicates the character of the subsoil, especially if it is unusual or abnormal.

We use the term clay to designate only true plastic clay, and not as it is so commonly, though incorrectly, used to describe almost any fine-grained soil or subsoil that is deficient in organic matter. True clay is like dough, being sticky or plastic and without individual particles distinguishable by the naked eye.

By the term silt is meant a grade of soil particles finer than sand, too fine to feel the individual grains with the fingers, but yet granular to the eye and not sticky or plastic when free from clay. Silt is

*These divisions are grouped together for the sake of simplicity, although the terms Pre-Iowan and Iowan recognize a greater difference in time of formation than the terms Early Iowan and Late Iowan which have been used tentatively.

by far the most common material in our ordinary prairie and timber soils and subsoils, although such soils also contain some smaller percentages of sand and clay.

In Table 3 is given the average composition in pounds per acre of the surface soil, approximately 7 inches deep (more exactly 6⅔ inches) of the most important soil types in the great soil areas of Illinois. These data are the average results of analyses of many representative samples of soil from each soil type numbered and named in the table. The last two figures in the official number designate the soil type and the preceding figure (or figures) the area in which it is found in accordance with the numbers on the soil map of Illinois, except that No. 11 may be used for both 9 and 11, and No. 10 may be used for both 10 and 12, because the same soil types are not uncommonly found on both moraines and plains. For a more complete outline of the classification of the soils of Illinois, the reader is referred to the appendix.

## THE MEANING OF SOIL ANALYSIS

In studying the composition of different soils it is well to keep in mind that our most productive soils of normal physical composition contain in the surface seven inches per acre about 8000 pounds of total nitrogen, 2000 pounds of total phosphorus, and above 30,000 pounds of total potassium.

The total nitrogen varies from about 2000 pounds in the yellow silt loam of the hill lands, or from less than 1500 pounds in the sand soil, to 8900 pounds in the black clay loam prairie of the Late Wisconsin glaciation and even to nearly 35,000 pounds in the peaty swamp soil.

The total phosphorus varies from about 800 pounds in the gray silt loam prairie of southern Illinois to about 2000 pounds as an average of the richest areas of black clay loam; while the total potassium varies from 3000 pounds in the peaty swamp soil to 48,000 in the Late Wisconsin yellow-gray silt loam.

For convenient study and ready comparison the twenty-five soils, comprising the most extensive and important types in the great soil areas, are arranged in the tables in five groups.

First, the group of undulating prairie lands, varying in topography from level to rolling, and including the somewhat peculiar gray silt loam on tight clay of the Lower Illinoisan glaciation in the Illinois wheat belt and the ordinary brown silt loam soils of the corn belt found in the six other glacial areas, and especially extensive in the Middle and Upper Illinoisan and in the Early Wisconsin glaciations, constituting by far the most common corn belt soils.

TABLE 3.—FERTILITY IN ILLINOIS SOILS
Average Pounds per Acre in Surface Soil (0-7 inches)*

| Soil type No. | Soil area or glaciation. | Soil type. | Total nitrogen. | Total phosphorus. | Total potassium. | Limestone required. |
|---|---|---|---|---|---|---|
| | | **Prairie lands, undulating.** | | | | |
| 330 | Lower Illinoisan. | Gray silt loam on tight clay..... | 2880 | 840 | 24940 | 2 to 5 tons |
| 426 | Middle Illinoisan | Brown silt loam..... | 4370 | 1170 | 32240 | Rarely |
| 526 | Upper Illinoisan.. | Brown silt loam..... | 4840 | 1200 | 32940 | Rarely |
| 626 | Pre-Iowan ..... | Brown silt loam..... | 4290 | 1190 | 35340 | ½ to 1 ton |
| 726 | Iowan..... | Brown silt loam..... | 4910 | 1220 | 32960 | ½ to 1 ton |
| 1126 | Early Wisconsin. | Brown silt loam..... | 5050 | 1190 | 36250 | Rarely |
| 1026 | Late Wisconsin.. | Brown silt loam..... | 6750 | 1410 | 45020 | Rarely |
| | | **Prairie lands, flat.** | | | | |
| 420 | Middle Illinoisan | Black clay loam..... | 5410 | 1430 | 31860 | None |
| 520 | Upper Illinoisan.. | Black clay loam..... | 6760 | 1690 | 29670 | None |
| 1120 | Early Wisconsin. | Black clay loam..... | 7840 | 2030 | 35140 | None |
| 1220 | Late Wisconsin.. | Black clay loam..... | 8900 | 1870 | 37370 | None |
| | | **Timber uplands, rolling or hilly.** | | | | |
| 135 | Unglaciated..... | Yellow silt loam..... | 1890 | 950 | 31450 | 2 to 5 tons |
| 335 | Lower Illinoisan. | Yellow silt loam..... | 2150 | 950 | 31850 | 2 to 5 tons |
| 435 | Middle Illinoisan | Yellow silt loam..... | 1870 | 820 | 33470 | 1 to 2 tons |
| 535 | Upper Illinoisan.. | Yellow silt loam..... | 2010 | 840 | 34860 | 1 to 2 tons |
| 635 | Pre-Iowan..... | Yellow silt loam..... | 2390 | 850 | 37180 | 1 to 2 tons |
| 35 | Iowan..... | Yellow silt loam..... | 1910 | 910 | 35780 | 1 to 2 tons |
| 1135 | Early Wisconsin. | Yellow silt loam..... | 1890 | 870 | 32720 | 1 to 2 tons |
| 864 | Deep loess..... | Yellow fine sandy loam..... | 2170 | 960 | 35640 | 1 to 2 tons |
| | | **Timber uplands, undulating.** | | | | |
| 1034 | Late Wisconsin.. | Yellow-gray silt loam | 2890 | 810 | 47600 | (?) |
| 760 | Iowan..... | Brown sandy loam ... | 3070 | 850 | 26700 | (?) |
| | | **Sand, swamp, and bottom lands.** | | | | |
| 1331 | Old bottom lands. | Deep gray silt loam.. | 3620 | 1420 | 36360 | 1 to 4 tons |
| 1451 | Late bottom lands | Brown loam..... | 4720 | 1620 | 39970 | Rarely |
| 1481 | Sand plains and dunes..... | Sand soil..... | 1440 | 820 | 30880 | (?) |
| 1401 | Late swamp..... | Deep peat ..... | 34880 | 1960 | 2930 | Rarely |

*The numbers given in Table 3 represent the total amounts contained in two million pounds of the surface soil on the dry basis, with the exception of peaty swamp soil, for which the amounts in one million pounds are used, because its specific gravity is only one-half that of ordinary soil, and of sand soil for which 2½ million pounds are used, because it is about one-fourth heavier than ordinary soil.

Second, the heavy black clay loam soils found in the very flat prairies, usually swampy before being drained, common in the Early Wisconsin and less common in the Middle and Upper Illinoisan and in the Late Wisconsin glaciation.

Third, the eroded yellow silt loams on sloping hillsides, the commonest soil type in the unglaciated area and also found on the broken lands adjoining water courses in most parts of the state; also the yellow fine sandy loam of the deep loess area, especially common on the bluffs adjoining the Mississippi and in places along other large streams.

Fourth, the undulating timber uplands of which only the yellow-gray silt loam of the Late Wisconsin and the brown sandy loam of the Iowan glaciation are discussed in this bulletin, these being extensive and consequently of special importance in those areas.

Fifth, the sand, swamp, and bottom land areas, which are discussed only with reference to sand soil, peaty soil, and very common bottom lands.

In both nitrogen and phosphorus the black clay loam which occupies the very flat prairie land in the northeast quarter part of Illinois is about two and one-half times as rich as the very extensive gray silt loam prairie land of the Lower Illinoisan glaciation.

In total potassium all of the soils of Illinois are extremely rich excepting the peaty swamp soil and this is extremely poor in this element containing less than one-tenth as much potassium as is found in normal fertile soils.

Even the sand soils are rich in total potassium, showing that much of the material is of granitic origin.

While the amount of plant food contained in the soil at depths below seven inches is of interest and will be found reported and discussed in the following pages, it should be kept in mind that the thing of chief concern and importance in systems of permanent profitable agriculture is to have and to maintain a good surface soil, for even a rich subsoil is of but little value if it lies beneath a worn-out surface. We know that we add manure and fertilizers to the plowed soil only and that by thus enriching the surface stratum we are able to increase markedly the crop yields. These well known facts plainly emphasize the importance of maintaining a rich surface soil at least 6 or 8 inches deep.

The downward movement of mineral plant food is very slight. Even soluble phosphates and potassium salts applied to the surface and harrowed in do not produce nearly so good results as when they are plowed down, thus putting them where the plant roots feed, which is chiefly below the first two or three inches.

A direct comparison of Table 1 and Table 3 is instructive and profitable.

It will be found, for example, that a hundred-bushel crop of corn removes from the soil 148 pounds of nitrogen, 17 pounds of phosphorus, and 19 pounds of potassium, assuming that the corn is harvested and the stalks are burned, which is still the most common practice in the Illinois corn belt. In the commonest corn belt land, the brown silt loams, there are as a general average (excluding the Late Wisconsin glaciation) about 4800 pounds of nitrogen, 1200 pounds of phosphorus, and 34,000 pounds of potassium. These amounts are sufficient to supply the nitrogen for such crops for 32 years, the phosphorus for 70 years, and the potassium for 1790 years.

Even the total nitrogen to a depth of 40 inches would extend the possible time limit for such crops to only 95 years for our most common Illinois corn belt land. It will be kept in mind of course that there is an inexhaustible supply of nitrogen in the air which can be drawn upon by means of legume crops with their nitrogen-fixing bacteria, but from Table 1 it will be seen that a ton of clover contains only 40 pounds of nitrogen, and it may be well to state here, and well for the reader to keep in mind hereafter, that the nitrogen contained in the clover roots will not exceed one-half of the amount contained in the total growth above ground. Thus to return the nitrogen removed by a hundred-bushel crop of corn would require a crop of clover amounting to two and one-half tons of hay together with the corresponding one and one-fourth ton of roots. In addition to this we must face the fact that not all of the nitrogen contained in the clover plant is taken from the air and that the loss of nitrogen by drainage is greater than the amount added in rain.*

It is a fact, however, that either by plowing under clover and other green manures and crop residues, or by more or less pasturing and by feeding the larger part of the crops grown and saving and returning all manure produced, the supply of nitrogen in the soil can be maintained or even increased.

If now we consider the element phosphorus we find that the total amount contained in the plowed soil of the commonest Illinois corn belt land is equivalent to the requirement of a hundred-bushel crop of corn each year for only 70 years if only the grain is harvested, or but 52 years if the grain and stalks were both removed. In the case of phosphorus instead of getting some permanent relief by

*Some nitrogen may be supplied by the soil bacteria (azotobacter) that fix atmospheric nitrogen independent of legumes, but no estimate of the amount can be made because of insufficient data.

growing clover we only hasten the depletion, for, as will be seen from Table 1, a four-ton crop of clover removes more phosphorus from the soil than is contained in 100 bushels of corn.

In Table 2 information is given showing the amounts of phosphorus contained in various materials that can be applied to the soil.

If we consider the element potassium we find that the average amount contained in the surface soil of the corn belt is sufficient to meet the needs of 100 bushels of corn per acre every year for eighteen centuries. Nevertheless the *liberation* of sufficient potassium and possibly of other elements, as sulfur, calcium, iron, or magnesium, even though the relative supply in the soil exceeds that of potassium, may become a very serious problem, and indeed already is a serious problem in soils which are deficient in decaying organic matter, as will be more fully explained in the discussion of specific soil types (see Lower Illinoisan gray silt loam prairie, No 330).

It should be kept in mind that while nitrogen is ever present in the air in inexhaustible quantity, the atmosphere does not contain phosphorus or potassium, and the only method of enriching the soil in either of those elements is by direct application to the land either in farm manure or other fertilizers.

In Tables 4 and 5 are given the amounts of plant food contained in the subsurface (*7-20 inches) and subsoil (20-40 inches) of these most extensive and important Illinois soil types. Except as previously explained the data given in Tables 3, 4, and 5 represent the amounts of plant food contained in two million pounds of surface soil, in four million pounds of subsurface soil, and in six million pounds of subsoil, an acre-inch of our ordinary silt loam and clay loam soils weighing about 300,000 pounds, dry basis.

All results are reported on the basis of pounds per acre, because the acre is the unit of measure on the farm. Crops are harvested and reported in yield per acre; the plant food removed is computed in pounds per acre; manures or fertilizers are applied in tons or pounds per acre; and in harmony with this practical system the composition of Illinois soils is reported and discussed also on the acre basis.† On this basis the stock of plant food in the soil is easily compared directly with the plant food removed in crops and applied in manures or fertilizers, and comparison between soil types or soil strata is also readily made.

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*More exactly from 6⅔ to 20 inches.

†To convert the data to the percentage basis divide by 2, 4, 6, according to the stratum, except that 1, 2, and 3 should be used for peat, and 2½, 5, and 7½ for sand, with proper placing of the decimal point in all cases.

TABLE 4.—FERTILITY IN ILLINOIS SOILS
Average Pounds per Acre in Subsurface Soil (7-20 inches)

| Soil type No. | Soil area or glaciation. | Soil type. | Total nitrogen. | Total phosphorus. | Total potassium. |
|---|---|---|---|---|---|
| | | Prairie lands, undulating. | | | |
| 330 | Lower Illinoisan | Gray silt loam on tight clay | 3210 | 1500 | 53570 |
| 426 | Middle Illinoisan | Brown silt loam | 5800 | 1920 | 62590 |
| 526 | Upper Illinoisan | Brown silt loam | 6480 | 2090 | 64820 |
| 626 | Pre-Iowan | Brown silt loam | 4650 | 2060 | 72370 |
| 726 | Iowan | Brown silt loam | 5140 | 1940 | 66220 |
| 1126 | Early Wisconsin | Brown silt loam | 6560 | 2000 | 72780 |
| 1026 | Late Wisconsin | Brown silt loam | 6870 | 1960 | 96420 |
| | | Prairie lands, flat. | | | |
| 420 | Middle Illinoisan | Black clay loam | 6180 | 2260 | 64070 |
| 520 | Upper Illinoisan | Black clay loam | 7380 | 2690 | 60760 |
| 1120 | Early Wisconsin | Black clay loam | 7200 | 3090 | 71670 |
| 1220 | Late Wisconsin | Black clay loam | 9100 | 2860 | 78840 |
| | | Timber uplands, rolling or hilly. | | | |
| 135 | Unglaciated | Yellow silt loam | 2030 | 2120 | 67320 |
| 335 | Lower Illinoisan | Yellow silt loam | 2170 | 2000 | 67380 |
| 435 | Middle Illinoisan | Yellow silt loam | 1980 | 1510 | 65370 |
| 535 | Upper Illinoisan | Yellow silt loam | 1900 | 1610 | 72570 |
| 635 | Pre-Iowan | Yellow silt loam | 2290 | 1750 | 76150 |
| 735 | Iowan | Yellow silt loam | 2120 | 1960 | 71180 |
| 1135 | Early Wisconsin | Yellow silt loam | 1870 | 1590 | 68690 |
| 864 | Deep loess | Yellow fine sandy loam | 2610 | 1600 | 71760 |
| | | Timber uplands, undulating. | | | |
| 1034 | Late Wisconsin | Yellow-gray silt loam | 2710 | 1390 | 111100 |
| 760 | Iowan | Brown sandy loam | 3920 | 1590 | 54300 |
| | | Sand, swamp, and bottom lands. | | | |
| 1331 | Old bottom lands | Deep gray silt loam | 2250 | 1830 | 68090 |
| 1451 | Late bottom lands | Brown loam | 6660 | 2160 | 77540 |
| 1481 | Sand plains and dunes | Sand soil | 2070 | 1480 | 62690 |
| 1401 | Late swamp | Deep peat | 64980 | 2940 | 7010 |

## COMPARISON OF DIFFERENT TYPES AND DEPTHS OF SOIL

Before passing on to the discussion of the composition and needs of the individual soil types and of results already secured from different methods of soil treatment or improvement, let us study briefly the general information given in Tables 3, 4, and 5.

TABLE 5.—FERTILITY IN ILLINOIS SOILS
Average Pounds per Acre in Subsoil (20-40 inches)

| Soil type No. | Soil area or glaciation. | Soil type. | Total nitrogen. | Total phosphorus. | Total potassium. |
|---|---|---|---|---|---|
| | | Prairie lands, undulating. | | | |
| 330 | Lower Illinoisan | Gray silt loam on tight clay | 3240 | 2400 | 84300 |
| 426 | Middle Illinoisan | Brown silt loam | 3440 | 2680 | 90040 |
| 526 | Upper Illinoisan | Brown silt loam | 3440 | 2790 | 98580 |
| 626 | Pre-Iowan | Brown silt loam | 3940 | 3380 | 102620 |
| 726 | Iowan | Brown silt loam | 3540 | 2780 | 99780 |
| 1126 | Early Wisconsin | Brown silt loam | 3420 | 2620 | 117880 |
| 1026 | Late Wisconsin | Brown silt loam | 3630 | 2630 | 160140 |
| | | Prairie lands, flat. | | | |
| 420 | Middle Illinoisan | Black clay loam | 3020 | 3030 | 94900 |
| 520 | Upper Illinoisan | Black clay loam | 3140 | 3640 | 96220 |
| 1120 | Early Wisconsin | Black clay loam | 3490 | 3630 | 111280 |
| 1220 | Late Wisconsin | Black clay loam | 3180 | 3930 | 125370 |
| | | Timber uplands, rolling or hilly. | | | |
| 135 | Unglaciated | Yellow silt loam | 1970 | 3280 | 105430 |
| 335 | Lower Illinoisan | Yellow silt loam | 2480 | 3170 | 99670 |
| 435 | Middle Illinoisan | Yellow silt loam | 2820 | 2810 | 99000 |
| 535 | Upper Illinoisan | Yellow silt loam | 2280 | 3270 | 100950 |
| 635 | Pre-Iowan | Yellow silt loam | 2380 | 3400 | 102100 |
| 735 | Iowan | Yellow silt loam | 2490 | 3900 | 105030 |
| 1135 | Early Wisconsin | Yellow silt loam | 2450 | 2660 | 103830 |
| 864 | Deep loess | Yellow fine sandy loam | 2730 | 3320 | 105210 |
| | | Timber uplands, undulating. | | | |
| 1034 | Late Wisconsin | Yellow-gray silt loam | 3240 | 2400 | 156740 |
| 760 | Iowan | Brown sandy loam | 4160 | 2440 | 81180 |
| | | Sand, swamp, and bottom lands. | | | |
| 1331 | Old bottom lands | Deep gray silt loam | 2280 | 2620 | 101610 |
| 1451 | Late bottom lands | Brown loam | 4150 | 2410 | 119520 |
| 1481 | Sand plains and dunes | Sand soil | 3100 | 2230 | 94030 |
| 1401 | Late swamp | Deep peat | 97730 | 3740 | 11510 |

The undulating prairie lands are arranged in order of age, the Lower Illinoisan being the oldest glaciation and the Late Wisconsin being the most recent. As we pass from the oldest to the newest soils there is a somewhat regular increase in plant food content. These nearly level or gently undulating prairie soils are less affected mechanically with the passing years than are other soils, such as the rolling hill lands, which lose by surface washing, or the bottom lands, which frequently receive deposits from overflow.

There are some marked evidences in morainal deposits and in soil composition of considerable differences in time of formation between the Lower Illinoisan, the Middle Illinoisan, the Early Wisconsin, and the Late Wisconsin glaciation and corresponding loessial deposits, but less marked evidences of any long periods of time having elapsed between the Middle Illinoisan, Upper Illinoisan, Pre-Iowan, and Iowan. Because of this the best comparison is made with the four areas first mentioned. The phosphorus varies in these soils from 840 to 1170, 1190, and 1410, and the potassium from about 25,000 to 32,000, 36,000, and 45,000 pounds per acre in the surface soil.

With the black clay loams which occupy some of the flat prairie lands, there are also some such relations indicated, although this type of soil is likely to be modified somewhat because of more or less deposit from overflows.

In the case of the yellow silt loams of the hill lands, which are always subject to more or less surface washing, there is no such gradation with the age of formation, because all of these soils were in the recent past unweathered subsoils from which the surface soil has been washed away during recent centuries.

Undoubtedly the lower amounts of phosphorus and potassium in the prairie land of the Lower Illinoisan glaciation as compared with the Late Wisconsin glaciation is in large part due to loss by longer weathering and leaching of the older formation during the long period of time that intervened between the earlier and later glaciers. Potassium, being much more subject to loss from weathering and leaching, is a better measure of this action than phosphorus. Even in the subsoils we find the potassium varying from 84,000 pounds in the Lower Illinoisan to 118,000 in the Early Wisconsin and 160,000 in the Late Wisconsin glaciation.

The nitrogen is a very good measure of the humus, or organic matter, being contained almost entirely in the organic matter, and consequently soils that are rich in phosphorus and potassium and highly productive for legumes and other plants are likely to be correspondingly richer in nitrogen than are soils poorer in the mineral elements.

While some of the phosphorus is always contained in the organic matter present in the soil, phosphorus being one of the constituents of humus, by far the larger part of the phosphorus is in mineral form; while the potassium is almost exclusively in the mineral form.

If a constituent were present uniformly in the different soil depths, then Table 4 would show twice as much, and Table 5 three times as much of such a constituent as Table 3, because the amounts of soil represented in the surface, subsurface, and subsoil are two

million, four million, and six million pounds, respectively. With potassium, in the yellow silt loam hill soils, this ratio obtains with some degree of uniformity. Thus, for the Lower Illinoisan glaciation the average amounts are 32,000, 67,000, and 100,000, in pounds for the respective strata, and for the Middle Illinoisan glaciation they are 33,000, 65,000, and 99,000; while 33,000, 66,000, and 99,000 would express the exact ratio. The ratio is exact with the Iowan brown sandy loam, the amounts of potassium being in round numbers 27,000, 54,000, and 81,000 pounds per acre for the three strata, surface, subsurface, and subsoil.

Some noticeable variations from this rule are the undulating prairie lands of the Lower Illinoisan and Late Wisconsin glaciations, the potassium numbers being for the Lower Illinoisan glaciation 25,000, 54,000, and 84,000 instead of 25,000, 50,000, and 75,000; and for the Late Wisconsin 45,000, 96,000, and 160,000 instead of 45,000, 90,000, and 135,000.

These variations may be explained perhaps by the longer weathering and more thorough leaching* of the surface soil of the older southern Illinois area, influenced also by the tight clay subsoil, and by the fact that in the Late Wisconsin area the loessial deposit is quite shallow, and the subsoil, even above 40 inches, may have been somewhat modified by glacial material.

The nitrogen, as already explained, is contained almost entirely in the humus, or organic matter, of the soil. Indeed the humus is a fairly good index of the nitrogen content of the soil. As would be expected from this the nitrogen content of most subsoils is very low because they contain but little humus. Thus in the Late Wisconsin black clay loam there are 8900 pounds of nitrogen in the surface seven inches, while in the 20 inches of subsoil, instead of finding

*A theory has been recently emphasized by Doctor F. K. Cameron of the United States Bureau of Soils (Cyclopedia of American Agriculture (1907) I., 370), to the effect that plant food tends to accumulate in the surface soil, the assumption being that larger amounts of soluble matter are brought up by the rise of capillary water than are carried down by the descent of rain water. While this is well known to be the case in arid or semi-arid regions where water leaves the soil not by drainage but only by evaporation, it is fully disproved for normal agricultural regions, not only by the fact that drainage waters always carry off some soluble plant food, but also by the fact, as illustrated in the above example, that old surface soils are poorer than the corresponding subsoils and lower subsoils in potassium, magnesium, lime and other materials that dissolve in the soil waters. The constituents that tend to accumulate in the surface soils in humid regions are deposited there as a part of the plant residues and include humus, organic nitrogen, and organic phosphorus, previously brought to the surface through the plant roots.

One of the best methods, and certainly the most common method, used by geologists for ascertaining the relative age of different soils is to determine the depth of soil from which some mineral constituent, as lime, has been leached out; whereas, according to the above theory, "there is a steady tendency toward an accumulation of dissolved mineral matter at the surface."

three times as much (as would be expected with potassium) we find only one-third as much total nitrogen (3180 pounds). In other words, the surface soil is nearly nine times as rich in nitrogen as the subsoil, equal weights of soil being considered.

With badly worn or washed soils, as the yellow silt loams of the hill lands, the surface may contain but little more nitrogen than an equal weight of subsoil, making the maintenance of humus and nitrogen by far the most important problem for such soils.

A study of the phosphorus content of the surface, sub-surface, and subsoil of the different groups of type soils plainly indicates, as already explained, that phosphorus is in part associated with nitrogen in the humus and in larger part contained in the mineral matter with the potassium. The surface of the brown silt loam undulating prairie lands averages about one-half richer in phosphorus than the surface of the hill lands but there is no such difference in the phosphorus content of the subsoils of those groups. Even between 20 and 40 inches these subsoils are much alike, and doubtless they are more nearly alike at or below the 40-inch depth, because even below 20 inches there is appreciably more humus and nitrogen in the prairie soils than in the hill lands.

Within the group of undulating prairie soils the phosphorus content of the surface seven inches varies from 840 to 1400 pounds per acre with a somewhat greater variation in nitrogen and, of course, in humus also, but in the subsoils this variation almost disappears not only for nitrogen but also for phosphorus.

Thus, we have in the soil chiefly organic nitrogen (in humus) and chiefly inorganic potassium (in mineral form), but we have both organic phosphorus and inorganic phosphorus. If we assume that the mineral part of the soil is of approximately uniform composition in surface, subsurface, and subsoil, where such is indicated by the potassium content, then we have a method for computing the amount of phosphorus that is organic and the amount that is in the inorganic or mineral form, in the surface soil.

Thus, in the Upper Illinoisan brown silt loam the potassium amounts to 33,000 pounds in two million of surface soil and to 99,000 pounds in six million of subsoil, suggesting a uniform mineral composition. The two million pounds of surface soil contain 4840 pounds of nitrogen and 1200 pounds of phosphorus, while two million pounds of the subsoil would contain 1150 pounds of nitrogen and 930 pounds of phosphorus. By subtracting we find that 270 pounds of phosphorus appear to be associated with 3690 pounds of nitrogen, or by the same ratio it appears that about 390 pounds of phosphorus are associated with the 4840 pounds of nitrogen contained in the humus in the surface soil. On this basis nearly one-

third of the phosphorus in this surface soil is organic* and two-thirds inorganic, or mineral, although for other types of soil very different proportions of organic and inorganic phosphorus may be found.

These considerations suggest an additional reason for emphasizing that "humus is the life of the soil," for in its decomposition products both nitrogen and phosphorus are liberated in forms available for plant growth. It is also suggested that while old and relatively inactive humus if present in sufficient amount may aid in the production of large crops by supplying the necessary nitrogen and phosphorus from its own constitution as it slowly decomposes in the soil, its decay might have but little effect in liberating phosphorus from the mineral compounds contained in, or applied to, the soil. To accomplish this result satisfactorily requires the action brought about by the bacteria and the various decomposition products of the more active, fresh, fermenting organic matter, as farm manure, legume crop residues, or other green manures.

## AVAILABLE PLANT FOOD

"Available plant food" is an expression much used in connection with commercial fertilizers, and the argument is commonly made that because the soil does not contain available plant food, we should therefore apply available plant food in commercial fertilizers. Instead of following this advice, however, the farmer should adopt a system of farming that will make available the plant food in the soil so far as practicable, and, if any element is actually deficient in the soil, apply that element in cheap form and in positively larger quantities than will be removed in large crops; and then make it, too, available by his method of farming.

There are three methods of determining with some degree of satisfaction which elements, if any, are deficient in the soil:

First, we may compute from Tables 1 and 3 the probable durability of a soil with reference to any element of plant food. Thus, we can determine that the unglaciated yellow silt loam surface soil contains sufficient nitrogen for less than 20 large corn crops if only the grain were removed; while the potassium in the Late Wisconsin brown silt loam is sufficient for more than 2300 such crops.

Second, we can assume for a rough estimation that the equivalent of 2 percent of the nitrogen, 1 percent of the phosphorus, and

*It may be that some portion of this phosphorus which apparently is or has been associated with the nitrogen in the organic form ultimately passes into difficultly soluble inorganic phosphorus compounds by uniting with the iron or aluminum in the surface soil.

¼ of 1 percent of the total potassium contained in the surface soil (Table 3) can be made available during one season by practical methods of farming. Of course, the percentage that can be made available will vary much with different seasons, with different soils, and for different crops; and yet with normal soils and seasons and for ordinary crops the above percentages represent roughly about the proportion that is liberated from the soil of the element that limits the yield of the crop.

In Table 6 are given the amounts of annually available plant food as roughly estimated by this method of computation.

Of course, these amounts would become smaller and smaller year by year in proportion as the total supply is decreased, and accordingly complete exhaustion is not only impracticable and unprofitable because of the continual reduction in crop yields, but it is mathematically impossible, just as it would be impossible to exhaust a bank account if only 1 percent of the remaining deposit could be withdrawn each week.

A peaty swamp soil containing 2930 pounds of total potassium per acre in the first seven inches would liberate during the season according to this estimate about 7 pounds of potassium, which would be equivalent to a crop of 10 bushels of corn, which represents roughly about the average yield from such land when not treated with potassium, as is shown in the following pages. The common brown silt loam prairie soil when well farmed will average about 50 bushels of corn per acre, which would require 11½ pounds of phosphorus and 74 pounds of nitrogen, while 12 and 96 pounds represent 1 percent of the phosphorus and 2 percent of the nitrogen, respectively, in the surface soil, where phosphorus is the first limiting element.

These illustrations are given not to prove that this rough estimation is applicable, but rather to show the basis which suggests such a computation. It has some value, chiefly, perhaps, in that it helps one to understand why it is that with phosphorus enough in the surface soil for 50 crops, we obtain only half a crop as an average.

On this basis we should try to keep sufficient phosphorus in the surface soil for 100 large crops, of which 1 percent would then be sufficient for one large crop. This would require about 2300 pounds of phosphorus per acre, or but little more than is actually contained in our most productive corn belt soil, as the Early Wisconsin black clay loam in such counties as McLean, Champaign, Edgar, *et al.* (see Table 3 and the appendix).

TABLE 6.—ANNUALLY AVAILABLE FERTILITY IN ILLINOIS SOILS, ROUGHLY ESTIMATED; POUNDS PER ACRE

| Soil type No. | Soil area or glaciation. | Soil type. | Available nitrogen. | Available phosphorus. | Available potassium |
|---|---|---|---|---|---|
| | | **Prairie lands, undulating.** | | | |
| 330 | Lower Illinoisan..... | Gray silt loam on tight clay..... | 58 | 8 | 62 |
| 426 | Middle Illinoisan..... | Brown silt loam..... | 87 | 12 | 81 |
| 526 | Upper Illinoisan..... | Brown silt loam..... | 97 | 12 | 82 |
| 626 | Pre-Iowan..... | Brown silt loam..... | 86 | 12 | 88 |
| 726 | Iowan..... | Brown silt loam..... | 98 | 12 | 82 |
| 1126 | Early Wisconsin..... | Brown silt loam..... | 101 | 12 | 91 |
| 1026 | Late Wisconsin..... | Brown silt loam..... | 135 | 14 | 113 |
| | | **Prairie lands, flat.** | | | |
| 420 | Middle Illinoisan..... | Black clay loam..... | 108 | 14 | 80 |
| 520 | Upper Illinoisan..... | Black clay loam..... | 135 | 17 | 74 |
| 1120 | Early Wisconsin..... | Black clay loam..... | 157 | 20 | 88 |
| 1220 | Late Wisconsin..... | Black clay loam..... | 178 | 19 | 93 |
| | | **Timber uplands, rolling or hilly.** | | | |
| 135 | Unglaciated..... | Yellow silt loam..... | 38 | 10 | 79 |
| 335 | Lower Illinoisan..... | Yellow silt loam..... | 43 | 10 | 80 |
| 435 | Middle Illinoisan..... | Yellow silt loam..... | 37 | 8 | 82 |
| 535 | Upper Illinoisan..... | Yellow silt loam..... | 40 | 8 | 87 |
| 635 | Pre-Iowan..... | Yellow silt loam..... | 48 | 9 | 93 |
| 735 | Iowan..... | Yellow silt loam..... | 38 | 9 | 89 |
| 1135 | Early Wisconsin..... | Yellow silt loam..... | 38 | 9 | 82 |
| 864 | Deep loess..... | Yellow fine sandy loam... | 43 | 10 | 89 |
| | | **Timber uplands, undulating.** | | | |
| 1034 | Late Wisconsin..... | Yellow-gray silt loam..... | 58 | 8 | 119 |
| 760 | Iowan..... | Brown sandy loam..... | 61 | 9 | 67 |
| | | **Sand, swamp, and bottom lands.** | | | |
| 1331 | Old bottom lands..... | Deep gray silt loam..... | 72 | 14 | 91 |
| 1451 | Late bottom lands..... | Brown loam..... | 94 | 16 | 100 |
| 1481 | Sand plains and dunes. | Sand soil..... | 29 | 8 | 77 |
| 1401 | Late swamp..... | Deep peat..... | (?)* | 20 | 7 |

*The nitrogen in peat is so very slowly available that not even a rough estimate can be made here.

Third, we may apply different elements of plant food to the soil and note the effect, if any, in increasing the yield of crops, and thus sometimes discover what element is most deficient in the soil. One might suppose that this would be the best method, but such is

not the case. This method frequently gives erroneous results which if followed may lead to land ruin, because the substance applied may produce little or no benefit on account of the special plant food element it contains but it may act as a powerful soil stimulant and thus liberate from the soil some other entirely different element in which the soil is already becoming deficient. Thus have many lands been practically ruined by the use of landplaster and salt, by the improper use of lime, and even by the use of clover merely as a soil stimulant. Some good illustrations of this action of soluble salts are shown in the following pages.

"In considering the general subject of culture experiments for determining fertilizer needs, emphasis must be laid on the fact that such experiments should never be accepted as the sole guide in determining future agricultural practice. If the culture experiments and the ultimate chemical analysis of the soil agree in the deficiency of any plant food element, then the information is conclusive and final; but if these two sources of information disagree, then the culture experiments should be considered as tentative and likely to give way with increasing knowledge and improved methods to the information based on chemical analysis, which is absolute."*

## PHOSPHORUS

In studying the field experiments reported below it is most important to keep in mind the amounts of phosphorus applied to and removed from the soil as well as the cost of the phosphorus applied. For reasons already explained, and completely established by the data and results secured, phosphorus is the only element that must be purchased and returned to our most common soils. *Phosphorus is the key to permanent agriculture on these lands.* To maintain or increase the amount of phosphorus in the soil makes possible the growth of clover and the consequent addition of nitrogen from the inexhaustible supply in the air; and, with the addition of decaying organic matter in clover residues and in manure made in large part from clover hay and pasture and from the larger crops of corn which clover helps to produce, comes the possibility of liberating from the immense supply in the soil sufficient potassium, when supplemented by that returned in manure and crop residues, for the production of large crops at least for thousands of years; whereas if the supply of phosphorus in the soil is steadily decreased in the future in accordance with the present most common farm practice, then poverty is the only future for the people who till the common prairie lands of Illinois. And this does not refer to the far distant

*Cyclopedia of American Agriculture, Volume 1, page 475.

future only, for the turning point is already past on many Illinois farms, and lands that have passed their prime with 60 years of cultivation will decrease rapidly in productive power and in value during another sixty years of similar exhaustive farm practice.

On land deficient in phosphorus the standard rule should be to apply phosphorus equivalent to 25 pounds of the element per acre per annum, remembering that a 100-bushel crop of corn removes 23 pounds of phosphorus. To supply 25 pounds of phosphorus will require 200 pounds of good steamed bone meal, costing about $2.50, or 200 pounds of good raw rock phosphate, costing about 80 cents, or 12½ tons of average fresh farm manure, or the manure that can be made from 200 bushels of corn, costing $70 or $80 as feed.

Probably the most practical and profitable method of maintaining the supply of phosphorus is by applying 1000 pounds per acre of raw rock phosphate once every five or six years, preferably in connection with all available farm manure, and for the first two or three applications one ton per acre of the phosphate may well be used. It will remain in the soil until removed by crops unless subject to surface washing.

If one adopts the rule that when he applies phosphorus it must be at the rate of at least 25 pounds per acre for each crop in the rotation (not 25 pounds of so-called phosphoric acid, nor 25 pounds of so-called bone phosphate, but 25 pounds of phosphorus), he will then be proof against the misleading and ruinous practice of using ordinary so-called complete commercial fertilizers, for he will at once discover that to buy 25 pounds of phosphorus in such fertilizers will cost from $8.00 to $10.00, and that the amounts he can afford to apply of such fertilizers will not furnish more than ¼ to ½ as much phosphorus as is actually removed from the soil in good crops.

In the field experiments reported in this bulletin the standard application of phosphorus in steamed bone meal is at the rate of 25 pounds per acre for each year in the rotation. This requires 600 pounds of bone for a three-year rotation, 800 pounds for a four-year rotation, etc. When raw rock phosphate is used, about three times as much is applied, which adds three times as much phosphorus to the soil but at about the same cost as for the bone. After two or three rotations the amount of rock phosphate to be applied will be reduced to one-third of the present applications.

Where farm manure is used the amount applied to any plot is in direct proportion to the total crop yields of the previous rotation. Thus, if the use of phosphorus increases the yield of crops in a rotation, it will likewise increase the possible production of manure, and consequently the application of manure is increased for the next rotation on plots where phosphorus and manure are used. Our

present plan is to apply the same number of tons per acre of average fresh manure (25 percent dry matter) as the number of tons of air-dry produce harvested, which requires about two-thirds of the produce to be used for feed and bedding and allows for a loss in practice of 20 percent of the manure produced.

## INDIVIDUAL TYPES OF ILLINOIS SOIL

In the tabular statements (Tables 3, 4, and 5) an absolute invoice is given concerning the stocks of plant food contained in twenty-five of the principal types of soil in Illinois. In the following description of the results obtained from pot cultures and field experiments and of systems of soil improvement adapted to these different types, it is necessary in some cases to discuss a single type in a single area, but so far as practicable similar types will be discussed in groups. It is the purpose of this bulletin to make the descriptions of each soil type sufficiently complete so that the reading farmer or landowner will recognize the soil of his own farm.

Of course, there are minor soil types and abnormal soils which will require the completion of the detail soil survey by counties (a work which is already well advanced), but three-fourths of the farmers of the state should be able to obtain from this bulletin some definite information applying directly to the stock of fertility contained in the soil of their own farms and even a larger number can profit by the adoption of suggested systems of soil improvement.

### GRAY SILT LOAM ON TIGHT CLAY (330)

This type of soil is the commonest prairie land in the Lower Illinoisan glaciation. This soil area is marked with the number 3 on the colored general survey soil map of Illinois. It lies chiefly between the Kaskaskia and Wabash rivers and is bounded on the south by the Ozark Hills and on the north by the terminal moraine of the Wisconsin glaciation which passes through Shelby, southern Coles, and Edgar counties. This area includes all of the counties of Fayette, Effingham, Jasper, Marion, Clay, Richland, Washington, Jefferson, Wayne, Perry, Franklin, and Hamilton, and parts of Montgomery, Shelby, Cumberland, Clark, Crawford, Lawrence, Wabash, Edwards, White, Saline, Williamson, Jackson, Randolph, Monroe, St. Clair, Clinton, and Bond.

In most of these counties the gray silt loam prairie soil (330) is the most common type, although it is not the only type in any county and probably not the only type in any township.

This type of soil is well known and everywhere recognized by the farmers themselves as "the common hardpan prairie." It con-

sists of a friable gray silt loam which commonly varies in depth from 6 to 12 inches and below which is a light gray or nearly white layer, or stratum, of slightly loamy silt varying from less than one inch to more than 10 inches in thickness, and commonly referred to as the "gray layer." At a depth of 16 to 20 inches the soil is underlain by a tight clay subsoil, frequently termed "hardpan."

It should be understood, however, that this subsoil is not true hardpan, which consists of sand or gravel cemented together with clay to form a substance which is practically impervious to water and through which ditches cannot be dug with only a spade. No true hardpan subsoil has yet been found anywhere in Illinois, unless it has been at considerable depths, as in the digging of wells.

The subsoil of this gray silt loam prairie is a tight clay, inclined to be gummy. Water passes through it, although quite slowly, and when wet it can be spaded without special difficulty, but when dry it becomes stiff and hard.

Where this soil is enriched by proper treatment excellent crops are grown in seasons of normal rainfall, but they are likely to suffer in times of drouth more than would be the case with a better subsoil. As a rule the rainfall in southern Illinois is abundant and well distributed during the growing season and where the top soil is kept fertile severe injury from drouth is not common.

From Table 3 it will be seen that the average surface soil of this type contains per acre 2880 pounds of nitrogen, 840 pounds of phosphorus, and 24,940 pounds of potassium, and that it requires an application of 2 to 5 tons of ground limestone. Compared with the requirements for a practical crop rotation this soil is very poor in phosphorus and very deficient in lime. Compared with the composition of fertile soils it is also deficient in humus as indicated by the total nitrogen.

It will be seen from Tables 1 and 3 that 50 bushels of wheat (grain only) remove from the land, and from the farm if sold, 12 pounds of phosphorus and 13 pounds of potassium; and that the total amounts of these elements in the surface soil of this type are sufficient to supply the phosphorus for 70 years and the potassium for 1900 years, provided they could be liberated as needed; or, if both grain and straw were removed, the phosphorus is equal to 52 such crops and the potassium to 520 crops.

It should be understood that the plant food contained in all soils is almost entirely in insoluble form, that growing crops can take up plant food only in soluble form, and that one of the problems always to be considered is how to enable the growing crops to secure sufficient plant food for maximum yields. If by the best systems of crop rotations, with proper use of green manures, and

in favorable seasons, we can liberate the equivalent of 1 percent of the phosphorus contained in the surface soil, it would amount to about 8 pounds per acre for the first year for the type of soil under consideration. This would be sufficient for a 25-bushel crop of wheat. If with less perfect systems only half of 1 percent is liberated, it would amount to 4 pounds, or enough for a 12-bushel crop of wheat.

On the University soil experiment field near Odin, Marion county, on this ordinary prairie land of the Lower Illinoisan glaciation, wheat is grown in a four-year crop rotation with clover, corn, and cowpeas. By having four different series of plots every crop may be grown every year.

As an average of the last four years (1904, 1905, 1906, and 1907), wheat grown in this rotation has produced 11½ bushels per acre with no special soil treatment, all crops having been removed.

Where one cowpea crop and some catch crops (as cowpeas seeded in the corn) had been plowed under during the rotation, the average yield of wheat was increased to 14 bushels.

Where lime or ground limestone had been applied and the cowpeas also plowed under the average yield of wheat has been 18½ bushels per acre. On this set of plots better cowpea crops and catch crops have been produced and turned under as green manure, because the soil acidity has been corrected by the lime, applied for the special benefit of the legume crops.

Where phosphorus has been applied in addition to the use of lime and green manure, the average yield of wheat during the four years has been 27 bushels; and where potassium also has been included the average yield has been 29½ bushels of wheat per acre.

These results are quite in harmony with what might be expected from the chemical composition of the soil. If, however, we consider the corn crops in the same rotation we have a somewhat different set of results.

The average yield of corn for the four years on the untreated rotated land has been 38 bushels per acre; with legume treatment (cowpeas turned under) 41 bushels; with legume and lime treatment 45 bushels; with legume, lime, and phosphorus 46 bushels; and with legume-lime-phosphorus-potassium treatment the average yield of corn for four years has been 61 bushels per acre. (See Plates 1 and 2).

For more convenient comparison these results are shown in Table 7.

TABLE 7.—CROP YIELDS IN SOIL EXPERIMENTS: ODIN FIELD

| Gray silt loam prairie Lower Illinoisan glaciation. | Average of eight tests in four years; two tests each year for each crop, bushels per acre. | |
|---|---|---|
| Soil treatment applied. | Wheat. | Corn. |
| None (except rotation) | 11.6 | 38.3 |
| Legume (cowpeas turned under) | 13.8 | 40.8 |
| Legume, lime | 18.5 | 45.3 |
| Legume, lime, phosphorus | 27.1 | 46.2 |
| Legume, lime, phosphorus, potassium | 29.5 | 61.3 |

These results are four-year averages. They were made in duplicate each year. They are representative and trustworthy. They have also been confirmed by results from other experiment fields on the same type of soil.

The effects upon corn of the green manure alone and with lime are about the same as upon wheat, but the effects produced by phosphorus and potassium are very different with the two crops, phosphorus producing the largest increase in wheat, while potassium is much more effective with corn, although potassium without phosphorus produces less increase in corn than when applied in addition to phosphorus.

A study of Table 1 will show that a 61-bushel crop of corn requires about 50 percent more potassium than a 30-bushel crop of wheat, which fact may account in part for the greater effect of potassium on corn, although about the same relation holds for phosphorus. A more important difference probably exists in the relative feeding powers of the two crops, influenced (1) by the difference in root systems, including the different depths of feeding, (2) by the difference in seasonal conditions and consequent difference in decay of humus and decomposition of other soil materials and in activity of soil organisms during the principal periods of growth, (3) by the solvent action of the carbon dioxid excreted by the bacteria and from the plant roots, and (4) possibly by different requirements as to the forms or combinations in which the plant food elements can be absorbed and assimilated or utilized by corn and wheat.

PLATE 1.—CORN CROP (29.4 bu.) WITH NO SOIL TREATMENT. ODIN SOIL EXPERIMENT FIELD, 1904.

PLATE 2.—CORN CROP (64.1 bu.) WITH LEGUME-LIME-PHOSPHORUS-POTASSIUM TREATMENT. ODIN SOIL EXPERIMENT FIELD, 1904.

A further very important question is whether more or less of the effect attributed to potassium may not be due to the stimulating action of the soluble potassium salt in liberating other substances from the soil instead of serving directly as plant food; and, if so, would it be advisable and more profitable to substitute some other less expensive material, such as kainit, for the concentrated potassium sulfate used in these experiments.

Information is accumulating from investigations now in progress which will help to solve these practical problems.

It can already be stated that as an average of 28 tests (including the use of twenty-five different varieties of corn) conducted in 1907 on the University experiment field near Fairfield in Wayne county, an application of 200 pounds per acre of potassium sulfate, containing 85 pounds of the element potassium and costing $5, increased the yield of corn by 7 bushels per acre; while 600 pounds of kainit containing only 60 pounds of potassium and costing $4, gave 10.1 bushels increase. These applications are made but once for a four-year rotation. The kainit with 25 pounds less potassium produced 3 bushels more corn than the sulfate. At 40 cents a bushel for corn the kainit has paid for itself the first year. As previously stated, kainit contains about 25 percent of potassium sulfate together with some magnesium sulfate, magnesium chlorid, and sodium chlorid, all of which are soluble salts; and the results plainly indicate that the effects produced are due not solely to the element potassium, but in part at least, and probably in large part, to the stimulating action of the soluble salt.

In this connection we may well consider results obtained at the Rothamsted Experiment Station in England where wheat has been grown on the same land every year for 56 years with different kinds of soluble salts applied to different parts of the field. As an average of 24 years (from 1852 to 1875) exactly the same increase was produced (5.6 bushels) whether 200* pounds of potassium sulfate, 280* pounds of magnesium sulfate, or 366½* pounds of sodium sulfate per acre per annum were applied. These results are not altogether conclusive because considerable potassium salts had been used on all three of these plots previous to the beginning of this 24-year test. During a second 24 years the average increases produced were 8.8 bushels by potassium sulfate, 6.6 bushels by magnesium sulfate, and 6.0 bushels by the sodium sulfate, showing that while the soluble salts of magnesium and sodium produce a marked effect, the potassium salt is becoming more

*Approximately molecular proportions. Excluding water of crystallization the amounts applied were 200 pounds of potassium sulfate, 137 pounds of magnesium sulfate, and 162 pounds of sodium sulfate.

effective and the difference of 2 or 2.8 bushels may be attributed to the value of the potassium itself as plant food. It may be said that the difference was much greater during the latter part of the second 24-year period and still greater subsequently. In 1906 the increase was 18.1 bushels by potassium sulfate, 7.8 bushels by magnesium sulfate, and 7 bushels by sodium sulfate, the potassium salt being now more than twice as effective as the other salts.

It should be stated that in the experiments reported above both at Fairfield, Illinois, and at Rothamsted, England, the soluble salts were applied in addition to phosphorus and the yields compared with the results obtained where the same amounts of phosphorus were applied without the soluble salts mentioned. Limestone was also provided in all cases. In neither case was farm manure applied and the soils are not well supplied with decaying organic matter, the action of which will largely, or, if provided in abundance, entirely take the place of the action of the soluble salts as such. Additional experiments on the Fairfield field include an equally complete test with kainit and potassium sulfate on land to which 8 tons per acre of farm manure had been applied. As an average of 28 tests with each material the 200 pounds of potassium sulfate increased the yield of corn by 2.9 bushels, while the 600 pounds of kainit gave 3.3 bushels increase, as compared with 7 bushels and 10.1 bushels increase, respectively, where these soluble salts were applied in the absence of manure, all other conditions being the same.

Thus, where farm manure is supplied the soluble salts produce but little effect and are not used with profit. On the other hand, phosphorus produces its greatest effect when used in connection with organic matter. As an average of three years on the Fairfield field rock phosphate and limestone in addition to manure have produced 12 bushels more corn per acre than has been produced where manure alone was used, although in the absence of either decaying organic matter or soluble salts the phosphorus produces much less effect, especially on corn.

In Table 8 are given the results obtained during the past six years on the DuBois experiment field in Washington county. In this field there are two independent series of ten plots each, and the crop yields reported in the Table are in all cases the average from two plots with like treatment.

For convenient comparison the lower part of Table 8 shows the total values of the crops produced during the last four years in this four-year rotation; also the value of the total increase and of the increase above that produced by lime alone.

TABLE 8.—CROP YIELDS IN SOIL EXPERIMENTS: DUBOIS FIELD

| Gray silt loam prairie Lower Illinoisan glaciation. | Average of two series each year, bushels or tons per acre. | | | | | |
|---|---|---|---|---|---|---|
| Soil treatment applied. | Corn, 1902. | Oats, 1903. | Wheat, 1904. | Clover, 1905. | Corn, 1906. | Oats, 1907. |
| None | 4.9 | 13.3 | 4.8 | 1.27 | 31.4 | 16.0 |
| Lime | 5.0 | 16.7 | 9.0 | 1.67 | 34.4 | 26.3 |
| Lime, nitrogen | 4.3 | 19.4 | 10.1 | 1.79 | 34.9 | 34.1 |
| Lime, phosphorus | 10.0 | 26.7 | 26.7 | 2.35 | 34.2 | 37.9 |
| Lime, potassium | 8.3 | 27.4 | 15.5 | 2.19 | 48.2 | 41.8 |
| Lime, nitrogen, phosphorus | 8.7 | 29.4 | 32.0 | 2.37 | 31.4 | 46.3 |
| Lime, nitrogen, potassium | 7.2 | 25.5 | 21.8 | 2.43 | 46.0 | 41.5 |
| Lime, phosphorus, potassium | 13.3 | 27.8 | 29.9 | 2.91 | 52.1 | 47.2 |
| Lime, nitrogen, phosphorus, potassium | 10.4 | 30.5 | 31.9 | 2.86 | 49.0 | 44.4 |
| Nitrogen, phosphorus, potassium | 3.4 | 29.4 | 27.8 | 2.69 | 45.3 | 36.1 |

Value of Crops per acre in Four Years, 1904, 1905, 1906, 1907.

| Soil treatment applied. | Total value of four crops. | Value of increase. | |
|---|---|---|---|
| None | $25.97 | ..... | Over lime |
| Lime | 34.82 | $ 8.85 | |
| Lime, nitrogen | 38.66 | 12.69 | $ 3.84 |
| Lime, phosphorus | 54.24 | 28.27 | 19.42 |
| Lime, potassium | 51.31 | 25.34 | 16.49 |
| Lime, nitrogen, phosphorus | 59.19 | 33.22 | 24.37 |
| Lime, nitrogen, potassium | 56.32 | 30.35 | 21.50 |
| Lime, phosphorus, potassium | 68.43 | 42.46 | 33.61 |
| Lime, nitrogen, phosphorus, potassium | 67.74 | 41.77 | 32.92 |
| Nitrogen, phosphorus, potassium | 60.49 | 34.52 | ..... |

The values are computed at 35 cents a bushel for corn, 25 cents for oats, 70 cents for wheat, and $6.00 a ton for clover hay. Not only are these prices conservative, but the quality of the crops from the well treated plots is much better than from the untreated land, especially for wheat and clover.

With an increase of $42.46 from one acre of land in four years above the total receipts from the untreated land one can well afford to improve the soil. Even with the use of 200 pounds of steamed bone meal at $25 a ton and 100 pounds of potassium sulfate at $50 a ton, making a cost of $5.00 an acre a year, the increase has paid the cost and added 100 percent profit for bone meal and 50 percent profit for the potassium used, besides leaving in the soil more than

half of the phosphorus applied and furnishing clover and other large crops from which to make manure.

From all data and information thus far secured, of which only a few average and trustworthy illustrations are mentioned in this bulletin, the following recommendations are made for the improvement of the common gray silt loam prairie land of the Lower Illinoisan glaciation:

1. Correct the acidity of the soil with an application of from two to five tons per acre of ground limestone, best applied after plowing in the summer or fall, and then mixed with the surface soil by disking or harrowing in preparing the seed bed for wheat or timothy where clover is to be seeded the next spring. (See Plates 3 and 4).

2. Adopt a good crop rotation in which clover or mixed clover and timothy shall occupy the land from one-third to one-half of the time.

3. Increase the stock of phosphorus in the soil by applying more than would be removed in large crops. An application of 1000 pounds per acre of raw rock phosphate every five or six years will accomplish this.

4. Increase the supply of active humus, or decaying organic matter, by pasturing during part of the rotation and by using for feed and bedding from one-half to two-thirds of the crops harvested, protecting the manure from exposure and loss by hauling directly from the stall and spreading with the phosphate upon the field preferably upon the new meadows or old pasture land to be plowed under for corn.

5. Where it is impossible at first to apply manure or to turn under liberal amounts of organic matter, an application of 400 to 600 pounds per acre of kainit in connection with the phosphate will help to grow larger crops for a time and thus increase the supply of organic matter to be returned in stable manure and by pasturing, after which the use of kainit may be discontinued.

The experiments now being conducted on this type of soil will ultimately furnish more complete information as to the effects of different crop rotations, of the continued use of stable manure, green manures, limestone, phosphorus in different forms, potassium sulfate and kainit; also the effect and practicability of subsoiling and of tile-drainage with the tile laid at different depths and covered with different materials, as with earth alone and also with a few inches of straw or cinders or gravelly sand before filling in with earth.

The results of these investigations will be published from time to time in bulletins or circulars which will be sent to all who ask to have their names placed upon the Experiment Station mailing list.

PLATE 3.—CLOVER (AND CRAB GRASS) WITH PHOSPHORUS ONLY: YIELD 1.05 TONS: EDGEWOOD SOIL EXPERIMENT FIELD, 1905.

Bulletin 99, "Soil Treatment for the Lower Illinois Glaciation," and Circular 110, "Ground Limestone for Acid Soils," are still available and will be sent to anyone upon request.

For more details concerning the chemical composition of this and other types of soil, see the appendix to this bulletin, and for further discussion of soil acidity see under the heading "yellow silt loam" in the following pages.

## BROWN SILT LOAM PRAIRIE SOILS (26)

Brown silt loam constitutes the most common prairie soil in the Middle and Upper Illinoisan, Pre-Iowan, and Early Wisconsin glaciations and is found to some extent also in the Iowan and Late Wisconsin. It is called "the ordinary prairie land" by farmers throughout the corn belt, extending from Coles, northern Macoupin, and McDonough counties to the north line of the State.

In the name of this soil type, brown silt loam, the term *brown* is used to designate about the same color as when used to describe a brown horse, as distinguished from a black soil or a black horse. The soil is not reddish brown or chocolate. It is dark colored but

PLATE 4.—CLOVER WITH LIME AND PHOSPHORUS: YIELD 2:10 TONS: EDGEWOOD SOIL EXPERIMENT FIELD, 1905.

not a genuine black under normal conditions, although when wet the darker phase of the type appears black.

All brown silt loams are given the soil type number 26, to which the number of the soil area is prefixed to designate the individual soil, as 426 for the Middle Illinoisan brown silt loam, 726 for the Iowan brown silt loam, etc. Not infrequently the brown silt loam extends over low or broad moraines as well as over the more extensive nearly level or undulating plains between the moraines, but only one number is used for the type within a single glaciation, as 1126 for the Early Wisconsin in which the type is more extensive on the intermorainal tracts, and 1026 for the Late Wisconsin, an area consisting largely of broad complex moraines on which more brown silt loam is found than on the smaller areas between the moraines.

While the different brown silt loams are similar in many respects, they differ somewhat in chemical composition, varying with age or formation of the different areas, and it is noteworthy that in the older soil areas the brown silt loam is either no longer represented (as in the Lower Illinoisan glaciation) or it is replaced to

some extent by a type of soil intermediate in character and value between brown silt loam and gray silt loam on tight clay. This intermediate type is well developed in places in the southern part of the Middle Illinoisan glaciation and in the western part of the Upper Illinoisan, but it is only one of many minor types whose exact location and investigation will be reported in connection with the detail soil survey by counties.

The top soil of the brown silt loam consists of a friable dark colored and fairly uniform soil to a depth of 16 to 20 inches with appreciably less organic matter at the lower depth. Below the top soil from 16 or 20 inches to 40 inches and more, is the yellow silty subsoil, somewhat less porous or friable than the top soil but not very compact.

This soil and subsoil have great capacity to absorb and retain water from heavy rains and later to deliver the moisture to growing crops as needed. In other words, the crops growing on brown silt loam soils are enabled to withstand drouths that would produce very severe damage on such a soil as the Lower Illinoisan gray silt loam on tight clay. Of course even the brown silt loam becomes much less absorbent and less retentive of moisture where the surface soil is allowed to become deficient in humus.

In Table 3 is given the average composition of the surface soil of the brown silt loam in each area. In nitrogen the brown silt loam of the Middle Illinoisan (426) and of the Pre-Iowan (626) is below the average. The former is the oldest and the latter the most rolling of the six brown silt loam areas, which may account for these lower averages. The phosphorus varies somewhat in harmony with the variation in nitrogen, except in the Early Wisconsin area. The Late Wisconsin brown silt loam (1026) is the most recent and also the richest in nitrogen, phosphorus, and potassium.

In the Pre-Iowan and Iowan glaciations the brown silt loam is commonly somewhat sour, the acidity being more marked in the subsurface and subsoil than in the surface, as is usually the case with strongly acid soils (see appendix for details). The principal type of upland soil in the Iowan glaciation is a sandy loam (760), further described in the following pages. The fact that the Pre-Iowan and Iowan brown silt loams contain more fine sand than is found in this type in other glaciations suggests that the higher acidity in these two areas may be due to an original deficiency in lime, the loessial deposit having been modified by the sandy material which is so commonly exposed and which must have contributed more or less to the glacial drift from which the loess was probably derived as already explained.

As a general average (the Late Wisconsin being disregarded) the brown silt loams contain in the surface soil of an acre about 4800 pounds of nitrogen, 1200 pounds of phosphorus, and 34,000 pounds of potassium, amounts which, if they could be drawn upon at will, would furnish the nitrogen for 100 bushels of corn (grain only) every year for 48 years, the phosphorus for 70 years, or the potassium for 1790 years. For four tons per acre of clover hay each year, the nitrogen, if drawn only from the surface soil, would be sufficient for 30 years, the phosphorus for 60 years, and the potassium for 280 years.

These data are for very large crops, and take into account only the plant food in the surface soil to a depth of seven inches but these crops are not too large to try to raise and the fertility of the surface soil must be maintained if we are to maintain a permanent profitable agriculture. We may reduce the crop yields to the lowest limit of profit on land valued at $150 to $200 an acre, but still the absolute limit in years is short for the nitrogen and phosphorus in this most common Illinois prairie soil; and, if such crops of corn and clover as are mentioned above had been removed from this land from the time Columbus discovered America until now, every pound of phosphorus contained in the soil to a depth of four feet would have been required for the crops grown.

Nitrogen can, of course, be secured from the air by means of clover and other legumes, but on any land capable of producing 40 or 50 bushels of corn per acre the soil will furnish as much nitrogen to the clover crop as will remain in the roots and stubble after the hay and seed crops are removed. In other words, to enrich such soil in nitrogen the clover crop must be returned to the land, either directly or in manure. The amount of clover necessary to be plowed under in order to furnish sufficient nitrogen to meet the needs of the grain or grass crops to be grown in the rotation can easily be computed from Table 1, and every farmer should make such computation for his rotation.

On the ordinary Early Wisconsin brown silt loam on the University soil experiment field at Urbana, a three-year rotation of corn, oats, and clover is practiced on three fields so that every crop is grown every year. As an average of the last three years, including three crops of corn, three of oats, and three of clover, the yields per acre have been 72 bushels of corn, 59 bushels of oats, and .89 ton of air-dry clover hay where no phosphorus has been applied; but where phosphorus has been applied on similar land in the same fields the average yields have been 90 bushels of corn, 71 bushels of oats, and 1.78 tons of air-dry hay. (See Plates 5 and 6).

PLATE 5.—CLOVER AFTER OATS WITH LIME TREATMENT: YIELD .87 TON: URBANA SOIL EXPERIMENT FIELD, 1905.

At 35 cents a bushel for corn, 25 cents for oats, and $6.00 a ton for hay, the value of the increase produced by the phosphorus is twice the cost of the phosphorus applied in the form of steamed bone meal, a form in which phosphorus costs nearly three times as much as in raw rock phosphate (see Table 2). Furthermore, the land to which no phosphorus was applied has lost 30 pounds of phosphorus per acre in the crops removed, while the bone meal applied contained 35 pounds more phosphorus than was removed in the three larger crops.

Where both bone meal and manure have been applied the average yield of corn was 93 bushels, and where potassium also has been applied in addition to the manure and phosphorus, the yield has been 96 bushels of corn, as a three-year average.

As a rule potassium is of little benefit on the brown silt loams, and not infrequently it reduces the crop yields. With two tests each year on each crop potassium produced an average increase of 3 bushels of corn and .16 ton of hay, but decreased the yield of oats by 2 bushels.

Table 9 gives results obtained during the past six years from the Sibley soil experiment field, located in Ford county on typical brown silt loam prairie of the Illinois corn belt.

PLATE 6.—CLOVER AFTER OATS WITH LIME AND PHOSPHORUS TREATMENT: YIELD 1:83 TONS: URBANA SOIL EXPERIMENT FIELD, 1905.

Table 9 is so easily understood that it is not necessary to take space here for a complete discussion of the data.

Previous to 1902 this land had been cropped with corn and oats for many years under a system of tenant farming and the soil had become somewhat deficient in active humus. While phosphorus was the limiting element of plant food, the supply of nitrogen becoming available annually was but little in excess of the phosphorus, as is well shown by the corn yields for 1903 when phosphorus produced an increase of 8 bushels, nitrogen without phosphorus produced no increase, but nitrogen and phosphorus increased the yield by 15 bushels.

After six years of additional cropping, however, nitrogen appears to have become the most limiting element, the increase in 1907 being 9 bushels from nitrogen and only 5 bushels from phosphorus, while both together produced an increase of 33 bushels of corn. By comparing the corn yields for the four years, 1902, 1903, 1906, and 1907, it will be seen that the untreated land has apparently grown less productive, whereas on land receiving both phosphorus and nitrogen the yield has appreciably increased, so that in 1907 when the untreated rotated land produced only 34 bushels of corn per acre, a yield of 72 bushels, or more than twice as much, was produced where lime, nitrogen, and phosphorus had been ap-

plied, although these two plots produced exactly the same yield (57 bushels) in 1902. While the actual yields might be quite different under different seasonal conditions, the relative and increasing differences between the plots must be considered as representative and due to the difference in soil treatment.

TABLE 9.—CROP YIELDS IN SOIL EXPERIMENTS:—SIBLEY FIELD

| Brown silt loam prairie Early Wisconsin glaciation. | | Corn, 1902. | Corn, 1903. | Oats, 1904. | Wheat, 1905. | Corn, 1906. | Corn, 1907. |
|---|---|---|---|---|---|---|---|
| Plot. | Soil treatment applied. | Bushels per acre. | | | | | |
| 101 | None | 57.3 | 50.4 | 74.4 | 29.5 | 36.7 | 33.9 |
| 102 | Lime | 60.0 | 54.0 | 74.7 | 31.7 | 39.2 | 38.9 |
| 103 | Lime, nitrogen | 60.0 | 54.3 | 77.5 | 32.8 | 41.7 | 48.1 |
| 104 | Lime, phosphorus | 61.3 | 62.3 | 92.5 | 36.3 | 44.8 | 43.5 |
| 105 | Lime, potassium | 56.0 | 49.9 | 74.4 | 30.2 | 37.5 | 34.9 |
| 106 | Lime, nitrogen, phosphorus | 57.3 | 69.1 | 88.4 | 45.2 | 68.5 | 72.3 |
| 107 | Lime, nitrogen, potassium | 53.3 | 51.4 | 75.9 | 37.7 | 39.7 | 51.1 |
| 108 | Lime, phosphorus, potassium | 58.7 | 60.9 | 80.0 | 39.8 | 41.5 | 39.8 |
| 109 | Lime, nitrogen, phosphorus, potassium | 58.7 | 65.9 | 82.5 | 48.0 | 69.5 | 80.1 |
| 110 | Nitrogen, phosphorus, potassium | 60.0 | 60.1 | 85.0 | 48.5 | 63.3 | 72.3 |

Value of Crops per acre in Six Years.

| Plot. | Soil treatment applied. | Total value of six crops. | Value of increase. | |
|---|---|---|---|---|
| 101 | None | $101.66 | ..... | Over lime. |
| 102 | Lime | 108.11 | $6.45 | |
| 103 | Lime, nitrogen | 113.78 | 12.12 | $5.67 |
| 104 | Lime. phosphorus | 122.71 | 21.05 | 14.60 |
| 105 | Lime, potassium | 102.15 | .49 | -5.92 |
| 106 | Lime, nitrogen, phosphorus | 147.26 | 45.64 | 39.19 |
| 107 | Lime, nitrogen, potassium | 113.80 | 12.14 | 5.69 |
| 108 | Lime, phosphorus, potassium | 118.18 | 16.56 | 10.11 |
| 109 | Lime, nitrogen, phosphorus, potassium | 150.20 | 48.58 | 42.13 |
| 110 | Nitrogen, phosphorus, potassium | 144.70 | 43.08 | ..... |

In the lower part of Table 9 are shown the total values per acre of the six crops from each of the ten different plots, the amounts varying from $101.62 to $150.20; also the value of the increase produced; first, above the untreated land; and, second, above the treatment with lime alone, corn being valued at 35 cents a bushel, oats at 25 cents, and wheat at 70 cents.

Phosphorus without nitrogen produced $14.63 in addition to the increase by lime, and *with nitrogen* phosphorus produced $33.49 in addition to the increase by lime and nitrogen, the principal part of these increases having been made during the later years.

The results show that in 17 cases out of 24 the addition of potassium decreased the crop yields.

By comparing plots 101 and 102, and also 109 and 110, it will be seen that the average increase by lime was about $6.00, or $1.00 an acre a year, suggesting that the time is near when lime also must be applied to these brown silt loam soils (see appendix).

Because of the tremendous importance of this most common soil type to Illinois agriculture and to the prosperity of the state, space is taken to insert Table 10 giving all of the results thus far obtained from the Bloomington soil experiment field, which is also located on the brown silt loam prairie of the Illinois corn belt.

The general results of the six years' work on the Bloomington field tell the same story as those from the Sibley field. The rotations differed by the use of clover and cowpeas in 1906, and in discontinuing the use of commercial nitrogen after 1905, on the Bloomington field, in consequence of which phosphorus without nitrogen (Plot 104) produced nearly as large an increase ($29.42) as the increase ($29.92) by phosphorus with nitrogen (Plot 106); whereas on the Sibley field phosphorus with nitrogen (Plot 106) produced more than twice as large an increase ($33.49) as the increase ($14.63) by phosphorus without nitrogen.

It should be stated that a draw runs near plot 110 on the Bloomington field and the crops on that plot are sometimes damaged by overflow or imperfect drainage as in 1903, 1904, and 1907; also that in 1902 the stand of corn on the Bloomington field was poor, though fairly uniform. Otherwise all results reported in Tables 9 and 10, including more than 100 tests, are considered reliable, and they furnish much information and afford many very interesting and instructive comparisons, as for example between Plots 104 and 106 and between 108 and 109 on the Sibley field where no legumes are grown in the rotation; also, between plots 103 and 106 and between 107 and 109 on both fields.

Wherever nitrogen was provided either by direct application or by the use of legume crops, the addition of the element phosphorus produced very marked increases, the average value being $33.31 for the six years, or $5.55 an acre a year. This is more than double its cost in steamed bone meal, the form in which it was applied to these fields. On the other hand, the use of phosphorus without nitrogen will not maintain the fertility of the soil (see Plots 104 and

106, Sibley field), and a liberal use of clover or other legumes is suggested as the only practical and profitable method of supplying the nitrogen, the clover to be plowed under, either directly or as manure, preferably in connection with the phosphorus applied, especially if raw rock phosphate is used.

TABLE 10.—CROP YIELDS IN SOIL EXPERIMENTS: BLOOMINGTON FIELD

| | Brown silt loam prairie Early Wisconsin glaciation. | Corn, 1902. | Corn, 1903. | Oats, 1904. | Wheat, 1905. | Clover, 1906. | Corn 1907 |
|---|---|---|---|---|---|---|---|
| Plot. | Soil treatment applied. | Bushels or tons per acre. | | | | | |
| 101 | None | 30.8 | 63.9 | 54.8 | 30.8 | .39 | 60.8 |
| 102 | Lime | 37.0 | 60.3 | 60.8 | 28.8 | .58 | 63.1 |
| 103 | Lime, nitrogen | 35.1 | 59.5 | 69.8 | 30.5 | .46 | 64.3 |
| 104 | Lime, phosphorus | 41.7 | 73.0 | 72.7 | 39.2 | 1.65 | 82.1 |
| 105 | Lime, potassium | 37.7 | 56.4 | 62.5 | 33.2 | .51 | 64.1 |
| 106 | Lime, nitrogen, phosphorus | 43.9 | 77.6 | 85.3 | 50.9 | ...* | 78.9 |
| 107 | Lime, nitrogen, potassium | 40.4 | 58.9 | 66.4 | 29.5 | .81 | 64.3 |
| 108 | Lime, phosphorus, potassium | 50.1 | 74.8 | 70.3 | 37.8 | 2.36 | 81.4 |
| 109 | Lime, nitrogen, phosphorus, potassium | 52.7 | 80.9 | 90.5 | 51.9 | ..* | 88.4 |
| 110 | Nitrogen, phosphorus, potassium | 52.3 | 73.1 | 71.4 | 51.1 | ...* | 78.0 |

Value of Crops per acre in Six Years.

| Plot. | Soil treatment applied. | Total value of six crops. | Value of increase. | |
|---|---|---|---|---|
| | | | | Over lime. |
| 101 | None | $92.03 | ..... | |
| 102 | Lime | 94.98 | $2.95 | |
| 103 | Lime, nitrogen | 97.18 | 5.15 | $2.20 |
| 104 | Lime, phosphorus | 124.40 | 32.37 | 29.42 |
| 105 | Lime, potassium | 97.30 | 5.27 | 2.32 |
| 106 | Lime, nitrogen, phosphorus | 127.10 | 35.07 | 32.12 |
| 107 | Lime, nitrogen, potassium | 99.37 | 7.34 | 4.39 |
| 108 | Lime, phosphorus, potassium | 130.41 | 38.38 | 35.43 |
| 109 | Lime, nitrogen, phosphorus, potassium | 136.66 | 44.63 | 41.68 |
| 110 | Nitrogen, phosphorus, potassium | 124.81 | 32.78 | ..... |

*Clover smothered out by previous very heavy wheat crop.

After the clover hay was harvested all ten of the plots were seeded to cowpeas and the crop was plowed under later on all plots as green manure for the 1907 corn crop.

From the best treated plots 90 pounds per acre of phosphorus have been removed from the soil in the six crops. This is equal to 7½ percent of the total phosphorus contained in the surface soil of

an acre. In other words, if such crops could be grown for 80 years they would require as much phosphorus as the total supply in the surface 7 inches of soil. The results plainly show, however, that without the addition of phosphorus such crops cannot be grown year after year. Where no phosphorus was applied the crops removed only 70 pounds of phosphorus in six years, or nearly 12 pounds a year, equivalent to almost 1 percent of the total amount (1200 pounds) in the surface soil.

The Auburn soil experiment field in Sangamon county is located on typical Middle Illinoisan brown silt loam (426). On that field phosphorus is applied in the form of raw rock phosphate, the initial application being one ton to the acre. A four-year rotation is practiced consisting of corn for two years followed by oats the third year and clover the fourth year. There are two independent series of plots and during the three years since the field was established three crops of corn and one of oats have been produced. In each series there are four plots treated with phosphorus and four others not treated with phosphorus, but in other respects they are treated alike. As an average of these four tests the rock phosphate increased the yield of corn by 7 bushels in 1905, by 1 bushel in 1906, and by 8 bushels in 1907, and increased the yield of oats by 8 bushels in 1907.

For the 1905 crop the phosphorus was applied and *plowed down* with a small growth of clover seeded with the previous oat crop, but for the 1906 crop the phosphorus may have been *plowed up* by deeper plowing, and if so it was probably chiefly in the two or three inches of surface soil where the corn roots do not feed appreciably, and this may account for its smaller effect for that season. Some other similar results under similar circumstances support this suggestion. Ultimately, of course, by repeated plowing, disking, etc., the rock phosphate will become well mixed with the plowed soil.

The Galesburg soil experiment field, located in Knox county on the Warren county line on typical Upper Illinoisan brown silt loam (526), has been in operation four years. A six-year rotation has been begun consisting of two years in corn, oats the third year, wheat the fourth year, and clover and timothy meadow the fifth and sixth years. It is absurd, of course, to expect anything like complete information as to the effects of soil treatment in connection with this crop rotation at this date. The first six years will be required to get the rotation properly underway and must be considered as a preliminary period. The second six years should furnish some reliable indications as to the probable effect of the different systems, and after that period definite and conclusive information should accumulate rapidly.

There are three independent series of plots in this field, of which one grows corn for two years, another grows oats one year and wheat the next, while the third grows mixed clover and timothy during the same two years, and the rotation is continued as given above. On series 100 corn was grown in 1904 and 1905, oats in 1906, and wheat in 1907, clover and timothy having been seeded for 1908 and 1909. On the 200 series oats were grown (on sod ground) in 1904, wheat in 1905, and mixed clover and timothy in 1906 and 1907. Series 300 was left in meadow for 1904 and 1905, and then cropped with corn in 1906 and 1907.

By using the corn, oats, and wheat data from the 100 series for the four years, the clover and timothy data from the 200 series, and the corn data from the 300 series, we have some preliminary results for each of the six crops comprising the rotation. As an average of four tests with and without phosphorus (8 tests for each corn crop) the raw rock phosphate used on this field increased the yield of first-year corn by 5.5 bushels and of second-year corn by 9.3 bushels, increased the yield of oats by 3.6 bushels in 1906 and wheat by 5.1 bushels in 1907, and increased the yield of hay by .26 ton in 1906 and by .53 ton in 1907. At the prices previously mentioned the increase in these six crops is worth $14.40 per acre.

The initial application of rock phosphate was 1½ tons per acre for the six-year rotation and this application is to be repeated for the second, and possibly for the third and fourth, rotations, after which 1000 pounds of rock phosphate are to be applied every six years. At $8.00 for the 12½ percent rock phosphate in carload lots, the 1½ tons cost $12.00 and added to the soil 375 pounds of the element phosphorus, of which the six crops on treated land removed about 68 pounds, leaving the soil richer in phosphorus by 307 pounds than at the beginning. At this rate this system will increase the phosphorus content of the plowed soil from 1160 pounds (the average of the Galesburg field in 1904) to nearly 1500 pounds in 1910, and to 1800 pounds (an increase of 50 percent) in 1916, and, if continued, to 2100 pounds per acre in 1922, and to 2400 pounds (double the original content) in 1928.

On the other hand it should be kept in mind that the six crops harvested from the untreated land left the soil poorer in phosphorus by 56 pounds per acre, which is 5 percent of the phosphorus present in the surface soil. While it is to be taken for granted that some part of this came from the subsurface and subsoil, the fact still remains that phosphorus is already so deficient in this soil as to limit the crop yields, and we may well ask ourselves the question whether we shall continue to reduce the productive power of the soil toward

ultimate land ruin, and thus become the curse of our own grandchildren or their children, or whether we shall adopt a system which assures even greater profits to ourselves and a richer soil as a heritage to our children, and greater future prosperity to the commonwealth of Illinois.

The Myrtle soil experiment field in Ogle county is located on the Pre-Iowan brown silt loam (626). Apparently phosphorus and nitrogen are about equally deficient. The experiments have been in progress for four years. Where rock phosphate was applied at the rate of 1 ton per acre for the initial application, with no adequate supply of decaying organic matter in the soil, but little effect has appeared in the grain crops, the average increase being 2.5 bushels per acre of corn and 1.6 bushels of oats.

With the clover crop, however, which it should be remembered need not be limited in yield because of any deficiency of soil nitrogen, having power to secure from the air nitrogen to supplement so far as necessary the soil's available supply, the effect of phosphorus has already been marked, the increase of air-dry clover hay as an average of four tests each year being .22 ton for 1906 and .63 ton for 1907. With the increased amount of clover residues and with the increased amount of manure to be made from the larger yield of clover hay and with the help of this decaying organic matter to liberate more phosphorus from the rock phosphate applied, increased crops of corn and other grains must follow on this field as they have on others.

No soil experiment fields have yet been established on the Iowan brown silt loam (726) nor on the Late Wisconsin brown silt loam (1026). Results similar to those reported for this type in other areas are to be expected in those areas, except that they will probably be less marked in the Late Wisconsin, especially on the better phase of the type, because of the higher percentages of both phosphorus and nitrogen in the brown silt loam of that area.

Additional soil experiment fields are greatly needed, and will be established as soon as sufficient funds are provided, not only on these most important soil types but also on several other more local and less extensive types, and not only for purposes of investigation but also to serve for demonstration and definite object lessons where farmers and landowners may see for themselves the results produced by the best and most profitable practice in soil improvement looking toward permanent systems of agriculture for the state, and conducted on soil types which they will be able to recognize on their own farms.

## RECOMMENDATIONS FOR BROWN SILT LOAM PRAIRIE SOILS

The information thus far secured is too meager to justify recommendations concerning many important problems relating to methods and systems of farming on the brown silt loam prairie soils, but two principles are already well established.

First, we must maintain or increase the supply of decaying organic matter in the soil, by means of crop rotations and the use of animal manures and green manures. A six-year rotation (similar to that on the Galesburg field) in which grain crops are grown for three or four years followed by mixed clover and timothy for two or three years in meadow and pasture, with about two-thirds of the total crops fed on the farm and all manure carefully saved and returned to the land, will certainly be approaching toward a permanent system for maintaining a sufficient supply of humus in the soil, as compared with the present most common soil-exhausting practice of growing from two to five crops of corn in succession, burning the stalks each year, and then substituting oats for one year, possibly with some clover seeded in the oats to be plowed under either the same fall or the next spring with a feeling that the land has been fertilized enough for three or four more corn crops.

Second, we must return to the soil in some form at least as much phosphorus as we remove in crops, and the weight of evidence thus far secured from properly conducted investigations is clearly in favor of using liberal amounts of fine-ground raw rock phosphate, with the full understanding that abundance of decaying organic matter is to be provided to assist in making the phosphorus soluble and available for growing crops.

To provide for as large crop yields as we ought to try to produce will require an application of 25 pounds of phosphorus per acre for each year in the rotation, preferably spread on the field at one time and plowed under with manure or other organic matter. The phosphorus content of the manure applied may of course be considered a part of the required amount. To increase the total amount of phosphorus in the surface soil to 2000 pounds per acre would require heavier applications for a few years. Three tons of rock phosphate containing 12½ percent of the element would add 750 pounds of phosphorus, and would cost at present prices from $25 to $30. This would raise the phosphorus content of the soil from 1200 pounds, the present average, to 1950 pounds. To determine whether it will be profitable to increase still further the total stock of phosphorus in the surface soil requires further investigation. The

750 pounds suggested above would equal the phosphorus required for 100 bushels of corn (grain only) every year for 44 years, or for 44 bushels (about the present average yield for the Illinois corn belt) every year for 100 years. In other words the man who increases the phosphorus content of his soil by 750 pounds provides the only element that need be purchased sufficient to meet the needs of the present average yields for another one hundred years, and at present prices for corn and rock phosphate the expense for such an application is no more than the value of one 70-bushel crop of corn.

It is very evident from the information already secured that we can thus not only increase the phosphorus content of the surface soil by more than one-half of our present stock, but also that the increase in crop yields in a proper system of farming will pay for such applications in a few years.

Further data are required, and are accumulating, concerning the effect of lime on the brown silt loams. As mentioned above the composition of this type in the Pre-Iowan and Iowan glaciations indicates that the use of limestone may be advisable and profitable in those areas. In the Middle and Upper Illinoisan and Early Wisconsin glaciations the supply of limestone in the brown silt loam is frequently already exhausted and on some fields very appreciable effects have followed its application.

For a more complete discussion of the effect of crop rotations, the value, and methods of increasing the value, of farm manure, and for additional data relating to soil improvement and the comparative value of different forms of phosphorus, Illinois readers are referred to Circular 96, "Soil Improvement for the Illinois Corn Belt," and to Circular 108, "Illinois Soils in Relation to Systems of Permanent Agriculture," which will be furnished free of charge upon request.

## Black Clay Loam Prairie Soils (20)

The commonest type of soil on the very flat prairie lands of the corn belt is black clay loam. As indicated by the name, it is black in color, clayey, or sticky and plastic, in texture, and rich in organic matter. It is commonly known as the heavy black prairie soil, and is sometimes called black gumbo land.

It is most abundant in the broad intermorainal tracts in the Early Wisconsin glaciation where it represents the richest Illinois prairie land existing in large area, containing as an average in two million pounds of surface soil about 7800 pounds of nitrogen, 2000 pounds of phosphorus, and 35,000 pounds of potassium.

In the Middle and Upper Illinoisan glaciations, which are older formations and have the natural drainage systems better developed, there are some smaller areas of black clay loam but in those areas this type of soil is not so rich in plant food. In the Late Wisconsin the extent of this type is quite limited.

Traces of acidity are sometimes found in the black clay loam, but it is never strongly developed, and usually the subsoil contains large amounts of limestone. (See appendix for details.)

The first problem with the black clay loam areas has always been to secure adequate drainage, but in most places this difficulty has been largely overcome by making large open dredge ditches and the laying of drain tile. Most of this land has been brought under profitable cultivation within the past 20 years and it has contributed much toward maintaining the average crop yields of the corn belt during recent years when the yields on the long-cultivated lands have been decreasing.

Where properly drained this black clay loam will continue to produce large yields for many years, provided sufficient rotation of crops is practiced to avoid too great development of injurious insects. It is probable however that even on this soil the best results will be obtained by adopting systems of farming and soil treatment that will maintain the present high content of phosphorus and prevent too great depletion of humus and nitrogen.

Investigations should be started at once to secure definite information concerning these points. As yet no soil experiment fields have been established on black clay loam because of the much greater present need for experiments on soils that are not so rich.

## YELLOW SILT LOAM HILL LAND (35)

This type of soil is sometimes called red clay hill land, and we have in a previous bulletin (115) called it red silt loam, but yellow better describes the prevalent color. It is found in all glaciations and much more abundantly (relatively) in the unglaciated areas. Like most of the soils of the state, it consists of a loessial deposit. It occupies much of the sloping lands or hill sides, not only in the original hilly sections of the state (the unglaciated, or driftless, areas), but also in the broken land regions along most of the interior streams. Under ordinary methods of cultivation these lands are subject to serious loss from surface washing, and even when not under cultivation there is and has been more or less rapid erosion taking place. Where this soil has been under ordinary cultivation for several years it is invariably poor in humus and nitrogen and

the dominant problem is to maintain or increase the organic matter in the soil, which will also increase the nitrogen, which is a constituent part of ordinary organic matter.

Of course the organic matter must in large part at least be grown upon the land and legume crops are most suitable for this purpose because their growth is not limited by the small nitrogen content of the soil and they also furnish green manures or animal manures rich in nitrogen.

While these soils are not rich in phosphorus, that element does not limit the yield of crops because the nitrogen limit is so much lower as measured by crop requirements and by numerous field and pot culture experiments. Furthermore, by surface washing the nitrogen, which is contained only in the humus, is rapidly depleted while the phosphorus is constantly renewed because of the supplies in the underlying materials. It is certain that for the highest crop yields phosphorus must be applied, and very probably it can ultimately be applied with profit in the best system of soil improvement and preservation, but as stated above the first requisite is an increase in humus and nitrogen.

There is, however, a serious difficulty to the growing of legume crops, especially for clover and alfalfa. This type of soil where it has been long under cultivation is markedly sour or acid. This applies especially to the unglaciated yellow silt loam (135) in the Ozark Hills region, comprising the principal type of upland soil in the counties of Union, Johnson, Pope, Hardin, Alexander, Pulaski, and Massac; and also to the Lower Illinoisan yellow silt loam (335) which occupies much of the sloping hill land in the remaining counties of "Egypt," extending northward to Shelby, Cumberland, and Jasper.

In the other glaciations this type of soil is less acid than in the Lower Illinoisan, but it is usually more or less acid in the Middle and Upper Illinoisan, in the Pre-Iowan and Iowan, and even in the Early Wisconsin glaciation.

The acidity is evidently at least very largely inorganic in character. This is indicated by the fact that the organic matter decreases rapidly in some of the most acid soils as we pass from surface to subsoil as measured either by total nitrogen or by total organic carbon, whereas in strongly acid soils the acidity increases with depth of soil and is several times stronger in the subsoil than in the surface. Indeed, in many strongly acid subsoils the acidity present is equivalent to several times the total possible humic acids basing the computations upon the total organic carbon and upon the accepted formula for humic acid and humates.

Acid silicates, formed from polysilicates, from which some basic elements may have been removed by reaction with soluble organic acids, or possibly by the long-continued weak action of drainage waters charged with carbonic acid, do exist in the soil and probably account for most of the acidity of soils that are at the same time strongly acid and very deficient in humus.

In the unglaciated area and in the Lower Illinoisan glaciation initial applications of at least two tons per acre of ground limestone are recommended for the yellow silt loam; and for the other glaciations one ton or more may well be applied where acidity is shown in the surface and subsoil and where difficulty is encountered in the growing of red clover.

One of the very best crops, and probably the most satisfactory and profitable crop, to be grown on these yellow silt loam soils is alfalfa. Its power to secure nitrogen from the air, to root deeply, and to live for many years are all very great advantages for this soil. Furthermore, experiments have shown that where the land is properly treated with heavy applications of ground limestone and thoroughly inoculated with the alfalfa bacteria and the alfalfa seeded on well prepared and well manured land at the proper time and given proper care, it grows luxuriantly and yields large and profitable crops on this soil. On the other hand to sow 20 to 25 pounds of good alfalfa seed on this soil without special and proper treatment is much like throwing away about $4.00 an acre.

Of course, if alfalfa is grown on this land it should all be fed on the farm and the manure returned to the soil, not only to help the alfalfa but also for other crops to be grown, such as corn and potatoes, which are a very profitable crop for this soil when properly enriched.

Table 11 gives the yields of corn, wheat, and clover obtained in 1907 on the Vienna soil experiment field in Johnson county, located on the less rolling phase of yellow silt loam in the unglaciated area.

The effect of the ground limestone, applied five years before, was to increase the crop yields in 1907 by 12.5 bushels of corn, by 6.9 bushels of wheat, and by 1.11 tons of clover hay. The quality of the crops was also improved, especially of the clover which was half weeds on plots 1 and 2 without limestone but good clean hay on plots 3, 4, and 5.

At 35 cents a bushel for corn, 70 cents for wheat, and $6.00 a ton for air-dry clover hay, the value of the increase produced by the ground limestone amounts to $15.87 for the three crops. At this rate the increase would pay for an application of about 27 tons of

TABLE 11.—CROP YIELDS IN SOIL EXPERIMENTS: VIENNA FIELD

| Yellow silt loam hill land. Unglaciated area. | | Series 100 corn, 1907. | Series 300 wheat, 1907. | Series 200 clover, 1907. | Value of three crops. | |
|---|---|---|---|---|---|---|
| Plot | Soil treatment applied. | Bushels or tons per acre. | | | Total. | Increase. |
| 1 | None | 16.7 | 4.3 | .65 | $12.76 | ..... |
| 2 | Legume | 17.8 | 6.1 | .81 | 15.36 | $ 2.60 |
| 3 | Legume, lime | 30.3 | 13.0 | 1.92 | 31.23 | 18.47 |
| 4 | Legume, lime, phosphorus | 37.1 | 13.6 | 2.56 | 37.87 | 25.11 |
| 5 | Legume, lime, phosphorus, potassium | 38.1 | 15.6 | 2.23 | 37.64 | 24.88 |

ground limestone per acre every six years, which is three times the applications actually made to this field, the effect of which will last many more years.

Crop yields from the Vienna soil experiment field for the five previous years, 1902 to 1906, pot culture experiments from this type of soil both from the unglaciated area and from the Upper Illinoisan glaciation, and other information will be found in Bulletin 115, "Improvement for the Worn Hill Lands of Illinois," which together with Bulletin 76, "Alfalfa on Illinois Soil," and Circular 110, "Ground Limestone for Acid Soils" will be sent free of charge upon request to the Agricultural Experiment Station, Urbana, Illinois.

## YELLOW FINE SANDY LOAM HILL LAND (864)

This type of soil occupies the deep loess areas covering the bluffs along the Mississippi river, the lower part of the Illinois river, and to a less extent along the Ohio and Wabash rivers. It resembles the yellow silt loams except that it contains more very fine sand which increases usually to a medium sand at great depth, in consequence of which the soil naturally has great power to absorb water even from heavy rainfall, the surplus passing into the more porous lower subsoil.

Because of this property this soil does not suffer from surface washing to such an extent as would be expected judged only from its topography. Of course, where the surface soil is allowed to become very deficient in organic matter its power of rapidly absorbing the water from heavy rainfalls is greatly reduced and the tendency to "run together" is greatly increased, both of which lessen its resistance to surface washing.

Frequently pieces of light shells are found in these deep loess deposits indicating river loess, and Professor Mosier has observed that where the river valley is wide the adjoining strip of deep loess over the bluffs is also wide, suggesting a distinct relation.*

Except where much erosion has recently occurred, this yellow fine sandy loam is acid and will be markedly benefited, especially for clover, alfalfa, and other legumes, by liberal applications of ground limestone. At least one or two tons should be used and four or five tons will give still better results, especially for alfalfa, for the growing of which this soil when properly treated is probably unexcelled.

In general the results reported above and in Bulletin 115 regarding the yellow silt loams apply with much force to this yellow fine sandy loam of very similar topography and chemical composition though differing in some physical properties in favor of the deep loess soil.

### YELLOW-GRAY SILT LOAM

The yellow-gray silt loams are found on the undulating upland areas that are, or were originally, timbered. The topography varies from nearly level to gently rolling, corresponding to the topography of the brown silt loam prairies.

While yellow-gray silt loam is found to some extent in every glaciation and also in the loess-covered unglaciated area, it is as a rule much less extensive than the prairie lands in the glaciated areas and much less extensive than the yellow silt loam in the more rolling hill land regions, as in the unglaciated area.

In the Late Wisconsin glaciation, which consists more largely of moraines than of intermorainal tracts, the yellow-gray silt loam (1034) appears to be relatively more extensive than in any other great soil area, and because of this fact this soil type in that area is included in this report of the general soil survey of the state, while in other areas its investigation will be reported only in connection with the detail soil survey by counties, which as previously explained is already well under way.

The yellow-gray silt loam varies from yellow to gray in the surface and as a rule there is more or less "gray layer" in the subsurface (especially in the older formations). In the Late Wisconsin glaciation, the loess covering being shallow, glacial material containing more or less gravel is frequently found in the subsoil within 40 inches of the surface.

*In southern Hardin county the only important area of deep loess covers the point at Rosiclare which is exposed to a long sweep of wind over the river bottoms from which clouds of silt and sand are still blown by strong winds when the river is very low and the bottom largely uncovered.

As shown in Table 3, the Late Wisconsin yellow-gray silt loam (1034) contains in the surface 7 inches about 2900 pounds of nitrogen, 800 pounds of phosphorus, and 47600 pounds of potassium. Compared with our more productive, more durable, and more valuable soils (as the Early Wisconsin black clay loam), this soil is very poor in phosphorus and quite low in humus as measured by the nitrogen or organic carbon (see appendix), while it is extremely rich in potassium.*

The total supply of phosphorus in the plowed soil (7 inches deep) is less than would be required for 35 crops of corn yielding 100 bushels of grain and 3 tons of stover, while the total nitrogen content even to a depth of 40 inches is less than would be required for 60 such crops, or for less than 90 crops if only the grain were removed, although the total potassium to a depth of 40 inches is sufficient to meet the requirements of a 100-bushel crop of corn every year for more than four thousand years, or for more than 16 thousand years if only the grain is removed. Notwithstanding these absolute facts, based upon accurate chemical analyses, showing such an enormous supply of potassium and a relatively small supply of nitrogen, the addition of soluble potassium salts, while not yielding profitable results, has actually produced a larger average increase than has been produced by nitrogen applied in dried blood on the Antioch soil experiment field in Lake county, on the Late Wisconsin yellow-gray silt loam, thus affording a good illustration of the fact that systems of soil treatment for permanent agriculture should not be based solely upon previous culture experiments.

*It is appropriate to mention in this connection that Doctor A. S. Cushman of the United States Department of Agriculture has recently emphasized (Science (1905) **22**, 838; and U. S. Dept. of Agr. Bureau of Plant Industry Bulletin 104) the possibility of using powdered granite and felspar as a source of potassium for fertilizing purposes, although some previous experiments with felspar (Svenska Mosskulturför. Tidskr. (1903) **17**, 360; (1904) **18**, 33, 73) have not given encouraging results. While it is by no means certain that granite averaging 4 percent of potassium or felspar with 8 or 10 percent of potassium may not be used with profit under some conditions, as where it can be secured as waste or by-product at very low cost near lands actually deficient in potassium, it is worth while to know that at $3.00 per ton for powdered granite the surface soil of the principal types in the Late Wisconsin glaciation already contains about $1800 worth of potassium per acre in the form of finely powdered granitic rock. In other words, two tons of this soil (or three tons of any silt loam soil in the Illinois corn belt) spread over an acre of land would supply as much potassium, and in the same form, as would be supplied by a ton of average powdered granite.

While the phosphorus content of the surface soil of most $150 Illinois land can be doubled by investing $25 to $40 per acre in raw rock phosphate at $8.00 per ton, to double the potassium content by applying powdered granite at a cost of only $3.00 a ton would cost from $1200 to $1800 per acre.

This soil is deficient in active humus and the soluble potassium salt acts in large part at least, if not entirely, as a soil stimulant rather than as plant food. As already shown by the results from Rothamsted, England, and from the Fairfield experiment field, other soluble salts may produce the same effect.

In Table 12 are given the results of six years' work on the Antioch soil experiment field.

TABLE 12.—CROP YIELDS IN SOIL EXPERIMENTS—ANTIOCH FIELD

| Soil plot Nos. | Yellow-gray silt loam undulating timber land: Late Wisconsin glaciation. Treatment applied. | Grain, bushels per acre. 1902 corn. | 1903 corn. | 1904 oats. | 1905 wheat. | 1906 corn. | 1907 corn. | Total value of crops for 6 years. |
|---|---|---|---|---|---|---|---|---|
| 101 | None | 44.8 | 36.6 | 17.8 | 18.5 | 35.9 | 12.4 | $ 62.80 |
| 102 | Lime | 45.1 | 38.9 | 12.8 | 10.3 | 31.5 | 9.5 | 54.16 |
| 103 | Lime, nitrogen | 46.3 | 40.8 | 2.8 | 17.8 | 37.8 | 6.4 | 59.12 |
| 104 | Lime, phosphorus | 50.1 | 53.6 | 12.5 | 35.8 | 57.4 | 13.4 | 89.27 |
| 105 | Lime, potassium | 48.2 | 50.2 | 9.7 | 21.7 | 34.9 | 12.9 | 68.79 |
| 106 | Lime, nitrogen, phosphorus | 56.6 | 62.7 | 15.9 | 15.2 | 59.3 | 20.9 | 84.45 |
| 107 | Lime, nitrogen, potassium | 52.1 | 54.9 | 10.3 | 11.8 | 39.0 | 11.1 | 65.83 |
| 108 | Lime, phosphorus, potassium | 60.7 | 66.0 | 19.7 | 28.7 | 59.1 | 18.3 | 96.46 |
| 109 | Lime, nitrogen, phosphorus, potassium. | 61.2 | 69.1 | 31.9 | 18.0 | 65.9 | 31.4 | 100.24 |
| 110 | Nitrogen, phosphorus, potassium | 59.7 | 71.8 | 37.2 | 16.3 | 66.3 | 28.8 | 100.02 |
| | Average gain for nitrogen | 3.0 | 4.7 | 1.6 | -8.4 | 4.8 | 3.9 | .26 |
| | Average gain for phosphorus | 9.2 | 16.7 | 11.1 | 9.0 | 24.6 | 11.0 | 30.61 |
| | Average gain for potassium | 6.0 | 11 0 | 6.9 | .3 | 3.2 | 5.9 | 11.08 |

Plot No. 1 is naturally better land than the others and both 1 and 10 serve only as checks against the lime treatment. They are not used in studying the effects of plant food applied.

The oats crop in 1904 and the 1907 corn crop were almost failures. The low yields of wheat from plots 3, 6, 7, and 9, in 1905, were due to the fact that the wheat on these nitrogen plots grew very rank and lodged badly before it ripened. The straw on these plots also rusted badly, resulting in shriveled and light grain.

The wheat yields on plots 2, 4, 5, and 8 are more trustworthy although too great weight must never be placed upon the results of a single season.

The total gains for six years show very markedly the effects of soil treatment. After the first year the best treated plots produced about twice as much as plot 2 which serves properly as a check plot, to which no nitrogen, phosphorus, or potassium, is applied.

Phosphorus increased the total value of the six crops from $54.16 to $89.26, a gain of $35.10 at a cost of $15 for steamed bone meal, leaving a net profit of $20.10 for phosphorus, or $3.35 per acre per annum. As an average of 24 tests under different conditions and extending over six different seasons, the gross increase produced by 600 pounds of nitrogen applied in $90 worth of dried blood amounts to 26 cents, or, if we disregard the loss on wheat, it amounts to $6.14.

A similar average shows that 150 pounds of phosphorus applied in $15 worth of steamed bone meal produced an increase valued at $30.61 with a net profit of more than 100 percent; while the soil is richer in phosphorus than six years ago by 87 pounds of phosphorus per acre.

The average of 24 tests shows $11.08 gross returns from $15 invested in 250 pounds of potassium. Counting that 50 pounds, or $3.00 worth, of the potassium applied still remains in the soil reduces the net loss to about $1.00.

On another part of the Antioch soil experiment field one ton per acre of raw rock phosphate is used in a four-year rotation of corn, corn, oats, and clover, started in 1904. Only small increases have been made thus far on the grain crops, but as an average of four different tests on a different field each year the phosphate increased the yield per acre of air-dry clover hay by 1.22 tons in 1905 and by .73 ton in 1907. Ultimately increased yields of clover must result in larger grain crops if the clover hay is fed and proportionate amounts of manure returned, as will be done on certain plots.

The results thus far secured clearly indicate the need of a larger supply of total phosphorus and of more active humus in this yellow-gray silt loam of the undulating timber uplands.

While the subsoil in the Late Wisconsin glaciation contains very large amounts of limestone (see appendix), the surface soil is sometimes slightly acid, but the information is not yet sufficient to determine whether the addition of ground limestone is advisable. It may be stated here however that in southern Illinois, especially in the Lower Illinoisan glaciation and in the unglaciated area, the yellow-gray silt loam is strongly acid and should receive from 2 to 5 tons of limestone per acre as an initial application, especially for the more successful growing of clover.

For more detailed discussion of the results from the Antioch field, Illinois readers are referred to Circular 109, "Improvement of Upland Timber Soils of Illinois."

## IOWAN BROWN SANDY LOAM (760)

This type of soil occupies a large part of the upland in the Iowan glaciation. The top soil consists of brown sandy loam containing some gravel in places and occasionally pieces of stone. The subsoil at a depth of three feet or more frequently contains much stone, and the proportion of stone increases with the depth, the disintegrating bed rock being found commonly at 4 to 10 feet beneath the surface.

In the surface and subsurface this type of soil is usually more or less acid, but the pieces of stone which are often, though not always, found in the subsoil above 40 inches contain some limestone, the underlying bed rock being on impure limestone.

The average composition of the Iowan brown sandy loam shows 3070 pounds of nitrogen, 850 pounds of phosphorus, and 26,700 pounds of potassium, in two million pounds of surface soil. While the nitrogen and phosphorus are low as compared with rich normal soils, it should be understood that porous sandy loam soils afford a much more extensive feeding range for plant roots than more compact soils, and consequently lower percentages of plant food elements may be adequate for the production of large crops on sandy loam soils.

On the other hand because of the porosity and thorough aeration of sandy soils the decomposition of organic matter is rapid. Thus, insoluble organic nitrogen is rapidly converted by nitrification into soluble nitrates and with the perfect natural drainage of sandy loam it is easily carried away in drainage waters, in consequence of which nitrogen is much more likely to be the limiting element in sandy soils than in more compact silt loams or clay loams of equal nitrogen content.

The Rockford soil experiment field is located on the Iowan brown sandy loam, about three miles north of Rockford, Winnebago county. A four-year rotation of corn, corn, oats, and clover is practiced on this field and there are four series of plots so that every crop may be represented every year, including first-year corn, second-year corn, oats, and clover. In the main nitrogen is supplied by legume crops and farm manure, with a single plot in each series to which commercial nitrogen is applied. Phosphorus is applied in raw rock phosphate both with and without manure, legume catch crops, and potassium sulfate, singly and in combination, thus mak-

ing a very complete and practical series of soil experiments, comprising in all 80 tenth-acre plots.

The Rockford field has been in operation only four years and the different systems are not yet fully underway. Thus on only one series and for only one year has first-year corn been grown where legume catch crops have been previously grown. The application of manure was purposely delayed until after some legume catch crops had been grown and plowed under in order to afford a comparison between these two methods of supplying humus and nitrogen. Of course, the action of raw rock phosphate will be slight at best in the absence of decaying organic matter. Not until 1909 will a clover crop be grown on manured land, and 1912 will be the first year in which oats will be grown on land manured for a previous clover crop. Thus, land manured for first-year corn in 1906 should be in clover in 1909 and the corn should be better because of the previous manuring. Because of this larger yield of clover, and of consequent larger amounts of manure to be returned, larger yields of corn should follow in 1910 and 1911 and of oats in 1912.

Some interesting and valuable results are to be looked for during the next four years, and still more subsequently, but at the present time the average results are to be considered as suggestive or indicative and by no means conclusive.

As an average of four years' tests 140 pounds of nitrogen, costing $21.00 in dried blood, have increased the yield of corn by 5.5 bushels, the yield of oats by 13 bushels, and (for the last two years only) the yield of clover hay by .13 ton per acre.

As an average of the crops grown during the four years, applications of 1000 pounds to 1 ton per acre of rock phosphate increased the yield of corn by 2.6 bushels per acre (32 tests), the yield of oats by .9 bushel (16 tests), and the yield of clover hay by .40 ton (8 tests in two years).

Potassium applied in 100 to 400 pounds of potassium sulfate, in addition to the phosphorus, produced as an average no effect on the corn or oats, and only .09 ton increase in the yield of clover hay.

These results indicate that nitrogen is the limiting element in this soil and that phosphorus also produces an appreciable effect, especially on clover. Limestone has been used during the last two years, but thus far without benefit.

As an average of six tests in each case 8 tons of manure per acre increased the yield of first-year corn by 5.6 bushels in 1906 and of second-year corn in 1907 by 5.7 bushels on the same plots without further manuring, and in 1907 on another series of plots 8 tons of manure increased the first-year corn by 9.1 bushels per acre.

Where legume catch crops (as cowpeas or soybeans) were seeded in the corn at the time of the last cultivation, the average effect on that corn crop has been to decrease the yield about 2 bushels, but where clover ground was plowed for corn in 1906 and legume catch crops decreased the yield of corn in 1906 by 1.3 bushels, the catch crops turned under for the next year increased the second-year corn crop in 1907 by 2.3 bushels in spite of the catch crops grown in the corn in 1907, thus suggesting, but not yet proving, that annual legumes as catch crops in the corn may ultimately be profitable.

From the chemical and physical composition of the soil and from the results already secured from the field experiments, a liberal use of farm manure and of legumes in rotation crops and pastures is recommended for this soil. Probably the use of rock phosphate, in addition to large supplies of organic matter, will prove profitable but further data are necessary to settle this and other questions.

## BOTTOM LAND SOILS

While there are many different types of bottom land soil in Illinois, only two of the most important and extensive types have been included in this general soil survey of the state.

### Deep Gray Silt Loam (1331)

Along the older water courses affording drainage for the Illinoisan glaciation (Lower, Middle, and Upper) and for the unglaciated area the principal bottom land is a deep gray silt loam (1331). As a rule this land is still subject to overflow in times of very high water and the soil is more or less variable in its content of humus, and consequently in nitrogen and phosphorus also. Its average composition shows about 3600 pounds of nitrogen, 1400 pounds of phosphorus, and 36,000 of potassium per acre in the surface 7 inches. Considering that the subsoil is much less compact than in most upland silt loams and affords a deeper feeding range for plant roots, its mineral content is sufficient for large crop yields, although long-continued cropping with no deposits from overflow will ultimately deplete the phosphorus supply.

The soil is almost invariably more or less acid and will be benefited, especially for the growing of clover or alfalfa, by a liberal use of ground limestone. From the acidity commonly present an initial application of at least one ton of limestone per acre is suggested, and better results are to be expected from applications of 2 to 4 tons per acre.

Aside from the use of limestone and good drainage the only immediate recommendation to be made for this deep gray silt loam is to maintain a sufficient supply of decaying organic matter by means of crop rotations or farm manure.

### BROWN LOAM (1451)

The principal soil type in the more recent bottom lands, as in the Wisconsin glaciation and along some of the larger streams, including some of the Mississippi bottoms, especially north of the mouth of the Kaskaskia river, is a brown loam (1451). It is quite porous and friable and contains more sand and more organic matter than the deep gray silt loam just described. As a rule it is not markedly acid and sometimes contains limestone, although slight acidity is liable to be found where the wash has been partly from the older Illinoisan area.

The brown loam contains in the surface soil about 4700 pounds of nitrogen, 1600 of phosphorus, and 40,000 of potassium, being richer in every constituent than the deep gray silt loam.

Drainage, protection from overflow (or better control of overflow), and good crop rotation should produce good results for many years, but with no deposits from overflow even this soil will ultimately become deficient in phosphorus if the crops grown are removed, although the deep feeding range afforded will postpone the time.

Other bottom land soils, of which there are many, varying from the heaviest plastic clay to river sand and gravel, are being mapped and investigated in connection with the detail soil survey. As yet no soil experiment fields have been established on bottom land soil, although some of the problems relating especially to heavy plastic clay soils of low productive power covering some extensive areas of bottom land can be solved only by field experiments.

## SAND AND SWAMP AREAS

As shown on the general survey soil map, there are some extensive areas in the state originally covered by swamps, sand plains and sand ridges or dunes. Notable among these areas are the Inlet Swamp in Lee county, the Winnebago and Green River Swamp in Lee, Whiteside, Bureau, and Henry counties, the sand and swamp areas in Tazewell and Mason counties, and the Kankakee Swamp in Kankakee and adjoining counties.

It should be understood that boundaries shown on the general survey soil map not only for swamp and bottom land areas, but for

moraines and great soil areas are not located with exactness, although in the main they are very approximately correct. So far as we have extended the detail soil survey (the mapping of twenty-seven counties being nearly completed at this date), we have found Leverett's work to have been very carefully done. Some minor corrections have been made where discovered before the preparation of the accompanying soil map, but it should be mentioned here that our detail work shows that the Vermilion Swamp or wide bottom land shown in Ford and Livingston counties does not extend to the Illinois river in LaSalle county, this error in Leverett's glacial map having been found too late to be corrected in our soil map.

## SAND SOIL (1481)

Sand soil is found both on sand plains and sand dunes where the sand has been blown into ridges varying from narrow drifts to extensive sand hill areas, sometimes covering many square miles, as in Tazewell and Mason counties.

In composition this soil averages about 1400 pounds of nitrogen, 800 of phosphorus, and 31,000 pounds of potassium in the surface 7 inches (2½ million pounds). The high percentage of potassium shows that this soil is not a pure quartz sand, but is to a considerable extent of granitic origin.

In composition this soil is extremely poor in nitrogen, rich in potassium, and fairly well supplied with phosphorus, if we consider its very porous character and the very deep feeding range afforded to plant roots.

The Green Valley soil experiment field is located on sand ridge soil about two miles southwest of Green Valley, Tazewell county. The soil varies from a very sandy loam to a slightly loamy sand that is easily drifted by the wind when not protected by vegetation. This field was broken out of pasture in 1902. In Table 13 are reported all results secured in six years from that part of the Green Valley field where nitrogen as well as other elements is supplied in commercial form.

Plots 1 (especially) and 2 in this series were naturally more productive than the other plots, it being the regular custom of the Experiment Station to use the most productive land for the untreated check plots if any such differences are apparent when the field is established, as was the case in this instance. Plot 1 serves only as a check against the lime treatment, and the average of plots 2, 4, 5, and 8 gives a more reliable basis of comparison for ascertaining the effect of nitrogen.

A four-year rotation of corn, corn, oats, and wheat is practiced on this part of the Green Valley field, and at the end of six years we are at the middle of the second rotation.

TABLE 13.—CROP YIELDS IN SOIL EXPERIMENTS:—GREEN VALLEY FIELD

| Soil plot Nos. | Sand ridge soil. Treatment applied. | Grain, bushels per acre. | | | | | | Total value of crops for 6 years. |
|---|---|---|---|---|---|---|---|---|
| | | 1902 corn. | 1903 corn. | 1904 oats. | 1905 wheat. | 1906 corn. | 1907 corn. | |
| 401 | None | 68.7 | 56.3 | 49.7 | 18.3 | 32.9 | 35.3 | $ 92.86 |
| 402 | Lime | 68.2 | 42.0 | 35.9 | 19.0 | 17.8 | 29.5 | 77.41 |
| 403 | Lime, nitrogen | 68.6 | 65.4 | 44.4 | 23.5 | 62.9 | 58.9 | 117.08 |
| 404 | Lime, phosphorus | 30.3 | 24.9 | 20.3 | 16.7 | 10.4 | 13.1 | 44.32 |
| 405 | Lime, potassium | 23.1 | 20.1 | 16.9 | 16.5 | 8.4 | 12.8 | 38.32 |
| 406 | Lime, nitrogen, phosphorus | 57.4 | 69.8 | 51.9 | 26.8 | 70.8 | 64.7 | 123.69 |
| 407 | Lime, nitrogen, potassium | 70.0 | 72.9 | 54.7 | 36.5 | 74.8 | 73.6 | 141.19 |
| 408 | Lime, phosphorus, potassium | 49.8 | 39.6 | 36.9 | 13.7 | 18.3 | 27.7 | 66.21 |
| 409 | Lime, nitrogen, phosphorus, potassium. | 69.5 | 69.8 | 47.8 | 36.2 | 66.4 | 73.6 | 135.05 |
| 410 | Nitrogen, phosphorus, potassium | 57.2 | 66.1 | 50.0 | 26.5 | 66.0 | 71.9 | 122.47 |
| | Average gain for nitrogen | 23.5 | 37.8 | 22.3 | 14.3 | 55.0 | 46.9 | 72.71 |
| | Average gain for potassium over nitrogen | 6.8 | 3.8 | 3.1 | 11.2 | 3.8 | 11.8 | 17.79 |
| | Average gain for phosphorus over nitrogen | —5.9 | .7 | .3 | 1.5 | — 3 | 2.9 | .22 |

To facilitate summarizing the six years' results the total value of the six crops from each plot is shown in the last column, and at the bottom of the table are shown the average increase in yield for each year and the total value of the six years' increase (1) for nitrogen under the four conditions (2) for phosphorus in addition to nitrogen (2 tests each year), and (3) for potassium in addition to nitrogen (2 tests each year). Nitrogen is so clearly the limiting element that the only question regarding phosphorus and potassium is, will either of them effect a further increase after nitrogen has been applied.

As an average of four tests covering six years the addition of nitrogen to this sand soil has produced increases valued at $72.71 an acre, averaging $12.12 a year, at a cost of $15.00 a year for 100 pounds of nitrogen in dried blood. In one instance the increase produced has actually exceeded in value the cost of the nitrogen applied, if we disregard the cost and effect of the potassium. Thus, the total value of the six crops from plot 5, treated with lime and potassium, is $38.32, while $141.19 is the corresponding value for

plot 7, which differs from plot 5 only by the addition of nitrogen. Under these conditions 600 pounds of nitrogen costing only $90.00 have produced an increase of $102.87 per acre in six years.

So far as we have discovered this is the only instance where the use of commercial nitrogen has paid its cost in the production of ordinary farm crops in Illinois, and even here we must not overlook the fact that $15 worth of potassium was associated with the $90.00 worth of nitrogen where this enormous increase was produced. While potassium without nitrogen produces no benefit on this sand soil, when applied with nitrogen the potassium has produced an average increase valued at $17.79 per acre in six years at a cost of $15.00, but in this case the influence and cost of the associated nitrogen must not be ignored. In no case has the total increase paid for the combined cost of the elements involved with nitrogen as one of them.

Potassium is evidently the second limiting element in this soil where decaying organic matter is not provided, but the limit of potassium is very far above the nitrogen limit.

During the six years plot 7, receiving nitrogen and potassium, produced 291.3 bushels of corn (averaging 72.5 bushels a year), 54.7 bushels of oats, and 36.5 bushels of wheat, per acre. To produce the increase of plot 7 over plot 5 would require about 75 percent of the total nitrogen applied. Thus, there has been a loss of 25 percent of the nitrogen applied, which is a smaller loss than usually occurs where commercial nitrogen is used. Without doubt larger yields would have been produced, especially of corn, if 150 or 200 pounds of nitrogen per acre per annum had been used, which would have increased the cost of nitrogen to $22.50 or $30.00, respectively, per acre each year.

It need scarcely be mentioned that commercial nitrogen is used in these and other experiments in Illinois only to help discover what elements are limiting the crop yields. It should never be purchased for use in general farming, but, if needed, secured from the atmosphere by legume crops to be returned to the soil directly or in manure.

It is interesting to note that on the sand soil the six years' increase from $15.00 worth of phosphorus (even when applied with nitrogen) is valued at only 22 cents, while on the yellow-silt loam soil on the Antioch field (Table 12) 26 cents represents the total increase from the use of $90.00 worth of nitrogen. Thus do soils differ. (See also peaty swamp land results described below).

On three other series of plots on the Green Valley soil experiment field a three-year rotation of corn, oats, and cowpeas is prac-

ticed, every crop being represented every year. On plots receiving lime and phosphorus and legume crops, as green manure, the yield of corn was 45.6 bushels in 1906 and 67.8 bushels in 1907, compared with 70.8 bushels and 64.7 bushels with lime, phosphorus, and nitrogen on plot 6 (see Table 13) and with 10.4 bushels and 13.1 bushels with no nitrogen on plot 4, for the respective years. On other plots receiving comparable treatment, where lime, phosphorus, and potassium were used with nitrogen-gathering legume crops as green manure the corn yields in the three-year rotation were 54.6 bushels in 1906 and 51.5 bushels in 1907, compared with 66.4 bushels and 73.6 bushels on plot 9 with nitrogen applied, and compared with 18.3 bushels and 27.7 bushels on plot 8 with no nitrogen for the same years.

The growing of legume crops and the use of farm manure (and possibly limestone) are the only recommendations made for the improvement of these well drained sand soils, although further tests may show profit from potassium until more organic matter is supplied. As a rule clover cannot be grown successfully on this land, but cowpeas and soybeans are well adapted to such soil and they produce very large yields of excellent hay or of grain very valuable for feed and also for seed.

Under the best conditions with good preparation and heavy manuring alfalfa can be grown on this sand soil, more than five tons of alfalfa hay per acre in one year having been grown on part of the Green Valley field. Both soybeans and alfalfa should be inoculated with the proper nitrogen-fixing bacteria. (See Plate 7.)

Heavy applications of ground limestone also may be especially beneficial in getting alfalfa started.

For more detailed information the reader is referred to Bulletin 76, "Alfalfa on Illinois Soil," and Bulletin 94, "Nitrogen Bacteria and Legumes."

PLATE 7.—TRIPLICATE TESTS OF THE EFFECT OF ALFALFA BACTERIA IN GROWING ALFALFA IN ORDINARY SOILS WITHOUT FERTILIZERS—JARS MARKED "BAC." CONTAIN ALFALFA BACTERIA.

## Peaty Swamp Lands

Peat is chiefly of two kinds, one being known as moss peat and the other as grass peat. Moss peat consists largely of dead and decaying sphagnum moss, and grass peat of the residues of coarse swamp grass, sedge, flags, etc.

Probably most of the Illinois beds are grass peat, although there is some moss peat in the state. Indeed, in the detail soil survey of Lake county one swamp of several acres was found where the sphagnum moss is still growing luxuriantly over a bed of moss peat.

Where the soil consists very largely of decaying peat to a depth of 30 inches or more, it is called deep peat (Soil Type No. 1401).

As shown in Table 3, deep peat contains in one million pounds of surface soil about 35,000 pounds of nitrogen, 2000 pounds of phosphorus, and 2900 pounds of potassium. This shows in the surface 7 inches of an acre about five times as much nitrogen as the Early Wisconsin black clay loam prairie. In phosphorus content these two soil types are about equal, but the peat contains less than one-tenth as much potassium as the black clay loam. Thus the total supply of potassium in the peat to a depth of 7 inches (2930 pounds) would be equivalent to the potassium requirement (71 pounds) of a hundred-bushel crop of corn for only 41 years, or if the equivalent of only one-fourth of one percent of this is annually available in accordance with the rough estimate previously suggested, about 7 pounds of potassium would be liberated annually, or sufficient for about 10 bushels of corn per acre.

In Table 14 are given all results obtained from the Manito experiment field on deep peat, which was begun in 1902 and discontinued after 1905. The plots in this field were one acre* each in size, being two rods wide and 80 rods long, and untreated half-rod division strips were left between the plots, which, however, were cropped the same as the plots.

The results of four years' tests as given in Table 14 are in complete harmony with the information furnished by the chemical composition of peat soil as compared with that of ordinary normal soils. Where potassium was applied the yield was from three to four times as large as where nothing was applied. Where approximately equal money values of kainit and potassium chlorid were applied slightly greater yields were obtained with the potassium chlorid, which, however, supplied about one-third more potassium than the kainit. On the other hand, either material furnished more potassium than was required by the crops produced.

*In 1904 the yields were taken from quarter-acre plots because of severe insect injury on the other part of the field.

TABLE 14.—CORN YIELDS IN SOIL EXPERIMENTS: MANITO FIELD TYPICAL DEEP PEAT SOIL

| Plot. No. | Soil treatment for 1902. | Corn 1902, bu. | Corn 1903, bu. | Soil treatment for 1904. | Corn 1904 bu. | Corn 1905 bu. | Four crops, bu. |
|---|---|---|---|---|---|---|---|
| 1 | None..... | 10.9 | 8.1 | None..... | 17.0 | 12.0 | 48.0 |
| 2 | None..... | 10.4 | 10.4 | Limestone, 4000 lb. | 12.0 | 10.1 | 42.9 |
| 3 | Kainit, 600 lb..... | 30.4 | 32.4 | Limestone, 4000 lb. Kainit, 1200 lb. | 49.6 | 47.3 | 159.7 |
| 4 | Kainit, 600 lb. Acidulated bone, 350 lb. | 30.3 | 33.3 | Kainit, 1200 lb. Steamed bone, 395 lb | 53.5 | 47.6 | 164.7 |
| 5 | Potassium chlorid, 200 lb. | 31.2 | 33.9 | Potassium chlorid, 400 lb. | 48.5 | 52.7 | 166.3 |
| 6 | Sodium chlorid, 700 lb. | 11.1 | 13.1 | None..... | 24.0 | 22.1 | 70.3 |
| 7 | Sodium chlorid, 700 lb. | 13.3 | 14.5 | Kainit, 1200 lb..... | 44.5 | 47.3 | .... |
| 8 | Kainit, 600 lb..... | 36.8 | 37.7 | Kainit, 600 lb..... | 44.0 | 46.0 | 164.5 |
| 9 | Kainit, 300 lb..... | 26.4 | 25 1 | Kainit, 300 lb..... | 41.5 | 32.9 | 125.9 |
| 10 | None..... | 14.9* | 14.9 | None..... | 26.0 | 13.6 | 69.4 |

*Estimated from 1903; no yield was taken in 1902 because of misunderstanding.

The use of 700 pounds of sodium chlorid (common salt) produced no appreciable increase over the best untreated plots, indicating that where potassium is itself actually deficient, salts of other elements cannot take its place.

Applications of two tons per acre of ground limestone produced no increase in the corn crops, neither when applied alone nor in combination with kainit, neither the first year nor the second.

Reducing the application of kainit from 600 to 300 pounds, for each two-year period, reduced the yield of corn from 164.5 to 125.9 bushels. The two applications of 300 pounds of kainit furnished 60 pounds of potassium for the four years, or sufficient for 84 bushels of corn (grain and stalks). The difference between this and the 125.9 bushels obtained is 42 bushels, about what was obtained from the poorest untreated plot.

The underdrainage provided for this experiment field was not sufficient for the best results, probably because of insufficient nitrification. In other experiments on peaty soil with imperfect drainage the addition of $15 worth of nitrogen with potassium produced about 15 bushels more corn than where potassium alone was used.

## OTHER PEATY AND ALKALI SOILS

Aside from deep peat, there are many other types of peaty soil, as will be seen from the classification of Illinois soil types given in the appendix. Thus we find shallow peat and medium peat, underlain with clay, sand, rock, etc., and also sandy peat and peaty loam; and in some instances peaty soils also contain alkali, consisting chiefly of harmless calcium carbonate (limestone) with smaller amounts of injurious magnesium carbonate.

In some cases these peaty soils actually contain a good percentage of total potassium, more commonly in the subsurface or subsoil, but sometimes in the surface soil also, and yet the untreated soil is unproductive while the addition of potassium salts produces large and very profitable increases in the yield of corn, oats, etc.

In pot culture experiments we have even been able by the addition of potassium sulfate to correct to a considerable extent the injurious property of magnesium carbonate that has been purposely applied to ordinary brown silt loam prairie soil which is known to contain abundance of available potassium.

These facts are mentioned here because we recommend, tentatively, the application of potassium salt to all classes of peaty and alkali soils that are unproductive after being well drained, whenever the supply of farm manure is insufficient. It should be understood that plenty of farm manure, preferably quick-acting, or readily decomposable, manure, such as horse manure, will supply potassium and thus accomplish everything that potassium salts can accomplish, and on some swamp soils manure produces good results where potassium is without effect.

In pot culture experiments soils containing injurious amounts of magnesium carbonate have been treated with calcium sulfate (landplaster) which brings about a double decomposition, or interchange, forming the harmless insoluble calcium carbonate (limestone) and the very soluble magnesium sulfate, which is subsequently leached out, leaving the soil productive.

The new Manito experiment field, located three miles east of Manito in Tazewell county on the Mason county line, is on alkali soil consisting of peaty, clayey sand with some gravel, and containing sufficient total potassium for normal crop yields.

In Table 15 are recorded the treatment applied and results obtained in 1907 on the new Manito field.

TABLE 15.—CORN YIELDS IN SOIL EXPERIMENTS:—NEW MANITO FIELD, PEATY ALKALI SOIL

| Plot No. | Treatment applied for 1907. | Corn, bu. per acre. |
|---|---|---|
| 201 | None | 8.8 |
| 202 W | Manure, 6 tons | 43.5 |
| 202 E | Manure, 12 tons | 64.9 |
| 203 | Potassium sulfate, 400 pounds | 73.0 |
| 204 | Calcium sulfate, 2 to 16 tons | 4.9 |
| 205 | None | 5.4 |

Plot 204 is divided into four equal parts and the calcium sulfate applied at the rate of 2 tons, 4 tons, 8 tons, and 16 tons, per acre, at a cost of $6.00 per ton. It produced no benefit in 1907. Whether it will assist in the removal of the magnesium carbonate by double decomposition and leaching and thus improve the soil in time, time alone will tell.

The 400 pounds of potassium sulfate are applied for a three-year rotation at an initial cost of $10.00. The increase of 66 bushels of corn produced the first year, at 35 cents a bushel, amounts to more than twice the total cost of the potassium. The manure also gave very excellent results.

In Table 16 are given all results obtained during six years' experiments on part of the Momence soil experiment field, located three miles south of Momence, Kankakee county, on peaty swamp land which contains much decaying peat and coarse sand in the surface and in the subsurface, with a clayey sand subsoil resting on impure limestone, while the surface, subsurface, and subsoil contain more than half of the normal amounts of total potassium (19,000, 47,000, and 73,000 pounds, respectively, per acre). The soil contains but little alkali.

After 1902 (when the corn was damaged by water) the land was tile-drained sufficiently well for ordinary years, but in the extremely wet season of 1907 the corn was planted very late and with the continued wet weather resulted in almost a complete failure.

Potassium was not applied to plot 102 for 1902 and 1903 and was not applied to plot 110 for 1904.

The untreated check plot 101 is naturally somewhat more productive than the other plots.

TABLE 16.—CROP YIELDS IN SOIL EXPERIMENTS: MOMENCE FIELD

| Plot No. | Peaty swamp land. Soil treatment applied. | Corn 1902. | Corn 1903. | Corn 1904. | Corn 1905. | Corn 1906. | Corn 1907. | 6 Crops. Bu. | 6 Crops. Value. |
|---|---|---|---|---|---|---|---|---|---|
| 101 | None | 6.9 | 14.9 | 4.8 | 6.8 | 6.8 | .3 | 40.5 | $14.18 |
| 102 | Lime (and potassium after 2 years) | 5.5 | 7.1 | 20.1 | 33.9 | 52.6 | 14.9 | ..... | * |
| 103 | Lime, nitrogen | 0.0 | 3.6 | 1.3 | 4.1 | 5.3 | .4 | 14.7 | 5.15 |
| 104 | Lime, phosphorus | 1.3 | 4.6 | .4 | 1.8 | 1.9 | .2 | 10.2 | 3.57 |
| 105 | Lime, potassium | 23.7 | 72.2 | 34.6 | 41.4 | 50.0 | 16.2 | 238.1 | 83.34 |
| 106 | Lime, nitrogen, phosphorus | 0.0 | 3.9 | .6 | 1.6 | 4.5 | .4 | 11.0 | 3.85 |
| 107 | Lime, nitrogen, potassium | 19.7 | 71.1 | 33.5 | 38.5 | 53.1 | 16.5 | 232.4 | 81.34 |
| 108 | Lime, phosphorus, potassium | 32.0 | 73.1 | 42.0 | 36.3 | 59.4 | 19.9 | 262.7 | 91.95 |
| 109 | Lime, nitrogen, phosphorus, potassium | 25.2 | 66.8 | 39.2 | 42.9 | 65.6 | 25.1 | 264.8 | 92.68 |
| 110 | Nitrogen, phosphorus, potassium | 24.1 | 70.4 | 19.0 | 24.8 | 51.3 | 23.4 | .... | ..... |

*In the table on the last page the average value from plots 103, 104, and 106 is shown but not used for computing increase.

These results from the new Manito field and from the Momence field, on abnormal swamp lands, as well as the results from DuBois and Antioch, emphasize the fact that, although some principles are well established and can be applied with normal results on normal soils, there are complex problems* still unsolved relating to some soils of large extent and of vast importance to the state.

Further information concerning this group of soils is given in Bulletin No. 93, "Soil Treatment for Peaty Swamp Land, including Reference to Sand and Alkali Soil," but unfortunately the supply of this bulletin is completely exhausted. A second edition, including additional information will be published as soon as possible.

*These problems may be chemical, physical, or biological, and their solution may require the application of science yet unknown. Thus, some essential element of plant food may be present in abundance but held in unavailable form by chemical combination or physical absorption; or there may exist in the soil still undiscovered some chemical substance injurious to agricultural plants or to necessary bacterial life; and the recent very extensive investigations by the United States Bureau of Soils indicate that conditions may be brought about, artificially at least, in which organic toxic substances develop that are injurious to plant growth.

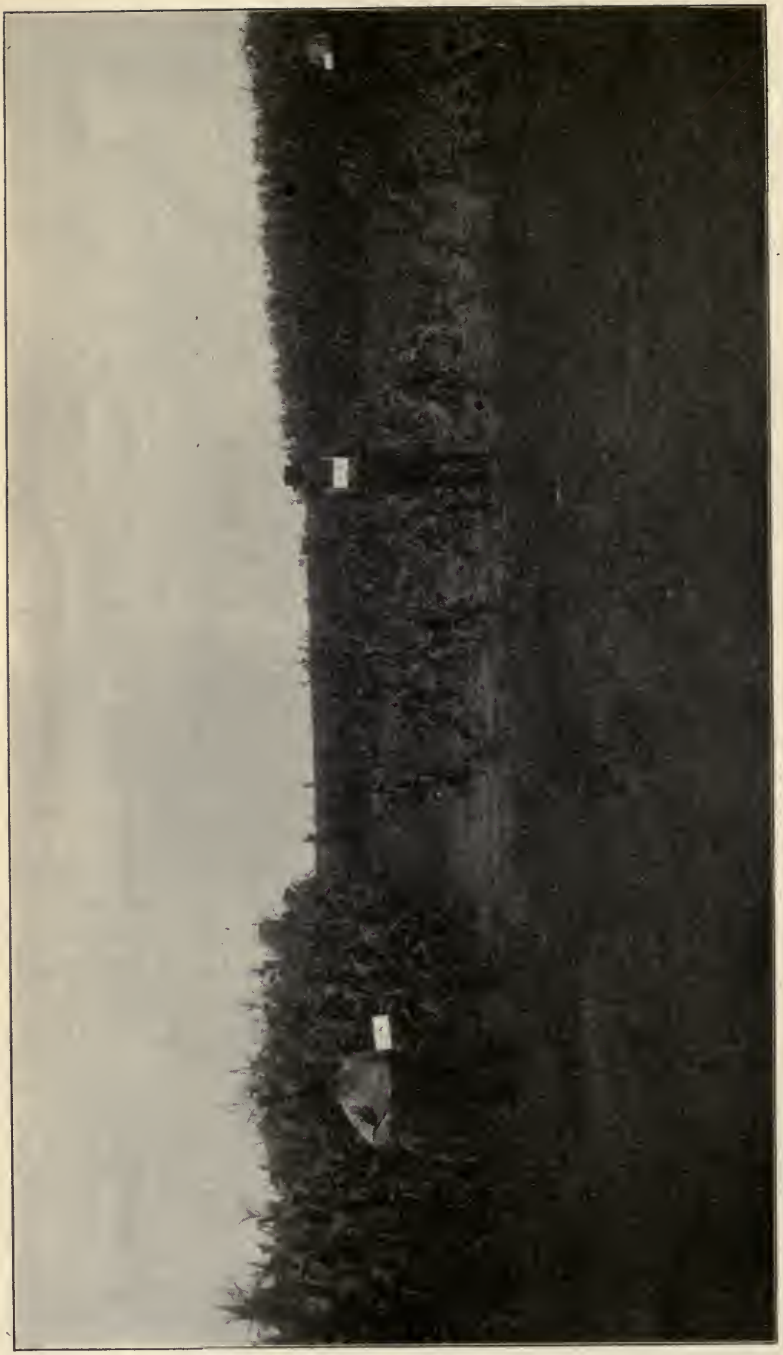

PLATE 8.—CORN ON PEATY SWAMP SOIL: EFFECT OF POTASSIUM; MOMENCE FIELD, 1903. (See Table 16).
YIELDS: PLOT 105=72.7 BU.; PLOT 106=3.9 BU.; PLOT 107=71.1 BU.

# APPENDIX A.

## CLASSIFICATION OF ILLINOIS SOILS

In the systematic or detail soil survey of the state the soils of Illinois are classified first according to the 14 great soil areas based upon the age or general method of formation.

GREAT SOIL AREAS OF ILLINOIS

| Number in hundreds. | Name. |
|---|---|
| 100 | Unglaciated areas |
| 200 | Illinoisan moraines |
| 300 | Lower Illinoisan glaciation |
| 400 | Middle Illinoisan glaciation |
| 500 | Upper Illinoisan glaciation |
| 600 | Pre-Iowan glaciation |
| 700 | Iowan glaciation. |
| 800 | Deep loess areas |
| 900 | Early Wisconsin moraines |
| 1000 | Late Wisconsin moraines |
| 1100 | Early Wisconsin glaciation |
| 1200 | Late Wisconsin glaciation |
| 1300 | Old river bottom and swamp areas |
| 1400 | Sand, late swamp and bottom lands |

Within these great soil areas the soils are classified in the following general groups, and within the limits of the numbers given:

SOILS: GENERAL GROUPS

| Number Limits | Group Names | Number Limits | Group Names |
|---|---|---|---|
| 0 to 9 | Peats | 50 to 59 | Loams |
| 10 to 12 | Peaty loams | 60 to 79 | Sandy loams |
| 13 to 14 | Mucks | 80 to 89 | Sands |
| 15 to 19 | Clays | 90 to 94 | Gravelly loams |
| 20 to 24 | Clay loams | 95 to 97 | Gravels |
| 25 to 49 | Silt loams | 98 | Stony loams |
| | | 99 | Rock outcrop |

In the final system of numbering and classifying individual soil types the Dewey library system of numbers is used, whole numbers being assigned to important and definite soil types and decimals employed for related types possessing some distinct variations. In all cases the name is designed to carry with it as complete a description as practicable of the soil type, so as to avoid any unnecessary tax on the memory of the student or farmer. Following is a list of the soil types thus far recognized in the detail soil survey of

Illinois. It should be understood, however, that to designate the individual soil type requires the soil area name and number (as hundreds) to be prefixed to the following soil type names and numbers. Thus, the Middle Illinoisan brown silt loam (426) is not the same soil type as the Late Wisconsin brown silt loam (1026), as will be seen from the preceding pages. Also the Old Bottom Land deep gray silt loam (1331) is not the same individual type as the Lower Illinoisan deep gray silt loam (331), a type found in small areas on the upland prairies in that glaciation, but not discussed in this bulletin. (The word "on" is used for depths less than 40 inches, while "over" is used for greater depths.)

ILLINOIS SOIL TYPES

| No. | Name |
|---|---|
| 1 | Deep peat |
| 2 | Medium peat on clay |
| 2.1 | Medium peat on clayey sand |
| 2.2 | Medium peat on sand |
| 2.3 | Medium peat on rock |
| 3 | Shallow peat on clay |
| 3.1 | Shallow peat on clayey sand |
| 3.2 | Shallow peat on sand |
| 3.3 | Shallow peat on rock |
| 10 | Peaty loam on clay |
| 10.1 | Peaty loam on clayey sand |
| 10.2 | Peaty loam on sand |
| 10.3 | Peaty loam on rock |
| 13 | Muck on clay |
| 13.1 | Muck on clayey sand |
| 13.2 | Muck on sand |
| 13.3 | Muck on rock |
| 15 | Drab clay |
| 15.1 | Sandy drab clay |
| 15.2 | Gravelly drab clay |
| 16 | Gray clay |
| 20 | Black clay loam |
| 20.1 | Sandy black clay loam |
| 20.2 | Gravelly black clay loam |
| 21 | Drab clay loam |
| 21.1 | Drab clay loam on sand |
| 22 | Gray clay loam |
| 25 | Black silt loam |
| 25.1 | Black silt loam on clay |
| 26 | Brown silt loam |
| 26.1 | Brown silt loam on clay |
| 26.2 | Brown silt loam on sand |
| 26.3 | Brown silt loam on till |
| 26.4 | Brown silt loam on gravel |
| 26.5 | Brown silt loam on rock |
| 27 | Brown silt loam over gravel |
| 28 | Brown-gray silt loam on tight clay |
| 29 | Drab silt loam |
| 29.1 | Drab silt loam on clay |
| 30 | Gray silt loam on tight clay |
| 31 | Deep gray silt loam |
| 32 | Light gray silt loam on tight clay |
| 32.1 | White silt loam on tight clay |
| 33 | Gray-red silt loam on tight clay |
| 34 | Yellow-gray silt loam |
| 34.1 | Yellow-gray silt loam on tight clay |
| 35 | Yellow silt loam |
| 35.1 | Yellow silt loam on tight clay |
| 35.2 | Yellow silt loam on clay |
| 35.3 | Yellow silt loam on sand |
| 35.4 | Yellow silt loam on gravel |
| 35.5 | Yellow silt loam on rock |
| 50 | Black loam |
| 50.1 | Black loam on clay |
| 51 | Brown loam |
| 51.1 | Brown loam on clay |
| 51.2 | Brown loam on silt |
| 51.3 | Brown loam on sand |
| 51.4 | Brown loam on gravel |
| 51.5 | Brown loam on rock |
| 52 | Gray loam |
| 53 | Yellow loam |
| 54 | Mixed loam |
| 60 | Brown sandy loam |
| 60.1 | Brown sandy loam on silt |
| 60.2 | Brown sandy loam on sand |
| 60.4 | Brown sandy loam on gravel |
| 60.5 | Brown sandy loam on rock |
| 61 | Mixed sandy loam |
| 62 | Brown fine sandy loam |
| 63 | Light brown fine sandy loam |
| 64 | Yellow fine sandy loam |
| 65 | Gray fine sandy loam |
| 80 | River sand |
| 81 | Dune sand |
| 82 | Beach sand |
| 90 | Gravelly loam |
| 95 | Gravel |
| 98 | Stony loam |
| 99 | Rock outcrop |

## APPENDIX B

In the following tables are recorded in detail the analyses of individual samples of soil, including surface, subsurface, and subsoil samples, from which the averages given in Tables 3, 4, and 5 were computed; but in addition to the constituents mentioned in the tables of averages, the detailed tabular statements show the limestone, present or required, the total organic carbon, and the acid-soluble phosphorus and potassium.

In the first column is given the location from which the sample (or set of samples) was taken. Thus, N.W., N.E., N.E., 15, 2 N., 1 E. 3rd P.M. is the commonly accepted method for expressing the exact location of the northwest quarter (10 acres) of the northeast quarter (40 acres) of the northeast quarter (160 acres) of Section 15, in Township 2 north of the base-line, and in Range 1 east of the third Principal Meridian, as established by the United States land survey.

The averages for the Lower Illinoisan gray silt loam prairie soil (330), as given in Tables 3, 4, and 5, are based on the analyses of 57 different samples of soil collected from nine different counties; and for the Early Wisconsin brown silt loam prairie soil (1126) analyses of 90 different samples from ten counties are represented; while for less extensive soil types smaller numbers of samples have been analyzed. It is believed that the data are sufficient to show to a satisfactory degree both the average composition and the local variations of each soil type.

In the third column is given the laboratory number for each individual sample of soil, by means of which any sample whose analysis is reported in the following tables can be identified in the store room, and, if desirable, further investigated, unless the supply has been exhausted, as is the case with a few samples among the early collections, in consequence of which some determinations are lacking.

All results are reported on the acre basis, 2 million pounds being used for the surface soil, 0 to 7 inches (or more exactly 0 to 6⅔ inches) in depth, 4 million pounds for the subsurface soil, 7 to 20 inches (or 6⅔ to 20) beneath the surface, and 6 million pounds for the subsoil, 20 to 40 inches deep, except that 2½, 5, and 7½ million pounds are used for sand soil, and 1, 2, and 3 million pounds for peat soil, because of their respective specific gravities.

By this means the results given are not only easily understood in practical application and readily compared, but they are exact,

being based only upon gravimetric measurements the same as percentages, to which they may be readily converted, if desired, by using as a divisor the number of millions of pounds mentioned, and pointing off four places. Thus, in soil No. 480 (first line in the following table) the 3380 pounds of nitrogen, 800 pounds of phosphorus, and 25,100 pounds of potassium, in 2 million pounds of surface soil, may be expressed as .169 percent of nitrogen, .040 percent of phosphorus, and 1.255 percent of potassium.

In the column headed "Limestone required" is given the number of pounds per acre of limestone (calcium carbonate) required to correct the soil acidity of the stratum named. The recommendations concerning limestone in Table 3 are based upon the average requirement to a depth of 20 inches and upon average results from field experiments.

The "Limestone present" is computed as calcium carbonate from the inorganic carbon found by liberating carbon dioxid from the soil with hydrochloric acid. For normal soils and for practical use this is believed to be of greater value than any other form of expression. In alkali soils, or others when of sufficient importance, all carbonates should be reported separately.

"Organic carbon" is accurately determined and reported as such, instead of attempting to determine or to report "organic matter," "volatile matter," or "loss on ignition." It may be assumed for rough estimation that organic matter is one-half carbon. In other words, the number of tons per acre of organic matter may be roughly indicated by pointing off three places in the number of pounds of organic carbon reported.

On this basis soil No. 684, of the Late Wisconsin black clay loam in DuPage county contains 116.6 tons of organic matter, and soil No. 474, of the unglaciated yellow silt loam in Johnson county, contains 17.6 tons of organic matter, per acre in the surface soil. The percentage of carbon increases with the age and decay of organic matter. Thus, fiber, or cellulose, contains 44 percent of carbon, while humic acid contains nearly 60 percent.

As an average strong hydrochloric acid (official method A.O.A.C.) dissolves 85 percent of the total phosphorus, but only 25 percent of the total potassium, with large variations, however, in each case. It is perhaps noteworthy that the older gray silt loam prairie soil of southern Illinois is not only lower in total potassium content, but that a smaller percentage of the total is soluble in acid than in case of the later brown silt loam or black clay loam prairies, general averages being considered in each case.

In the last column are recorded the strata sampled. Each soil sample analyzed is a composite sample composed of six to ten representative borings from as many different places where the soil appears to be typical. The depth of sampling for the surface is designed to be the depth of the plowed soil, but we have come to adopt 7 inches (or 6⅔ inches of well settled soil) as a standard for that stratum. Between the subsurface and subsoil we try to divide on the subsoil line, commonly found near 20 inches in our most extensive soil types, and we sometimes discard an inch or two at the subsoil line in order to secure subsurface and subsoil separately and not a mixture of the two. Where there is no fairly distinct line of division we make the separation at 20 inches. The subsoil is sampled to a depth of 40 inches, which is about 1 meter, a depth frequently used in other countries.

In conclusion, attention is called to the fact that in many respects there are fairly uniform and characteristic chemical distinctions between the most important and extensive soil types, aside from the most marked and regular differences between extreme types (as sand and peat). Thus, with all the natural variations in nitrogen and phosphorus, the highest figures for the southern Illinois gray silt loam prairie rarely equal the lowest for the brown silt loams of the corn belt; while the highest figures for the brown silt loams rarely equal the lowest for the black clay loams in the same areas. Soil acidity, or requirement of limestone, may be as constant a characteristic for one soil or subsoil, as the presence of limestone is for another. On the other hand, it must be borne in mind that variation and gradation is the universal law of nature, applying to soils even more strongly perhaps than to rocks, plants, and animals; and yet soils can be surveyed, mapped, and classified or graded, physically, chemically, and agriculturally, as well as apples, corn, or cattle, all of which are commonly marketed by grades or classes.

ILLINOIS SOIL TYPE NO. 330: LOWER ILLINOISAN GLACIATION; GRAY SILT LOAM ON TIGHT CLAY; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.W., N.E., N.E., 15, 2 N., 1 E. 3rd P.M. | Marion | 480 | Surface | 780 | | 33980 | 3380 | 800 | 25100 | 560 | 3860 | 0 - 5 |
| | | 481 | Subsurface | 5160 | | 28400 | 2800 | 1480 | 52280 | 720 | 7720 | 5 - 18 |
| | | 482 | Subsoil | 31800 | | 30300 | 3360 | 2400 | 76980 | 1680 | 24240 | 18 - 42 |
| S.W., N.E., S.W., 4, 2 N., 1 E. 3rd P.M. | Marion | 483 | Surface | 280 | | 36940 | 3280 | 860 | 26260 | 620 | 3520 | 0 - 5 |
| | | 484 | Subsurface | 3920 | | 42840 | 4280 | 1200 | 55720 | 1120 | 8120 | 5 - 16 |
| | | 485 | Subsoil | 10500 | | 27600 | 3120 | 2220 | 83280 | 2160 | 20580 | 18 - 42 |
| N.W., S.W., S.W., 14, 2 N., 1 E. 3rd P.M. | Marion | 487 | Surface | 300 | | 30160 | 2960 | 660 | 24660 | 620 | 3860 | 0 - 6 |
| | | 488 | Subsurface | 4720 | | 19000 | 3200 | 1560 | 53880 | 1120 | 8520 | 6 - 17 |
| | | 489 | Subsoil | 8040 | | 20400 | 3780 | 2580 | 80100 | 2220 | 24240 | 21 - 42 |
| S., S.E., S.E., 30, 6 N., 5 E. 3rd P.M. | Effingham | 491 | Surface | 1800 | | 31980 | 2800 | 720 | 24800 | 500 | 4160 | 0 - 5 |
| | | 492 | Subsurface | 5440 | | 36360 | 3240 | | | 760 | 7720 | 5 - 20 |
| | | 493 | Subsoil | 27900 | | 41280 | 3900 | 1620 | 73320 | 1320 | 22740 | 21 - 42 |
| N., S.E., N.W., 19, 5 S., 4 W., 3rd P.M. | Perry | 497 | Surface | 460 | | 23760 | 2140 | 800 | 26100 | 480 | 3380 | 0 - 6 |
| | | 498 | Subsurface | 3680 | | 26360 | 2600 | 1320 | 54800 | 560 | 9400 | 6 - 18 |
| | | 499 | Subsoil | 13860 | | | 3120 | | | 2400 | 27060 | 20 - 42 |
| S.W., N.W., N.E., 8, 5 S., 1 W. 3rd P.M. | Perry | 501 | Surface | 1180 | | 24680 | 2300 | 700 | 23460 | 720 | 3480 | 0 - 6 |
| | | 502 | Subsurface | 6720 | | 24040 | 2400 | 1440 | 48880 | 1320 | 8360 | 6 - 17 |
| | | 503 | Subsoil | 25080 | | 21420 | 2820 | | | 2700 | 26640 | 18 - 42 |
| S., S.E., N.E , 29, 3 S., 1 W. 3rd P.M. | Washington | 505 | Surface | 1120 | | 27760 | 2760 | 980 | 24680 | 800 | 4080 | 0 - 6 |
| | | 506 | Subsurface | 7080 | | 29080 | 2880 | 1680 | 50240 | 1200 | 9480 | 6 - 17 |
| | | 507 | Subsoil | 26520 | | 28860 | 2640 | 3180 | 79140 | 2700 | 26280 | 20 - 44 |

ILLINOIS SOIL TYPE NO. 330: LOWER ILLINOISAN GLACIATION: GRAY SILT LOAM ON TIGHT CLAY: UNDULATING PRAIRIE

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.W., S.E., N.W., 5, 2 N., 6 E. 3rd P.M. | Clay | 599 | Surface | 1180 | | 29060 | 3160 | 920 | 26440 | 840 | 5140 | 0 - 6 |
| | | 600 | Subsurface | 11240 | | 29240 | 4320 | 1400 | 52120 | 1320 | 12440 | 6 - 16 |
| | | 601 | Subsoil | 25560 | | 25200 | 3780 | 1980 | 85320 | 1800 | 25860 | 17 - 40 |
| S.W., S.E., N.W., 5, 2 N., 6 E. 3rd P.M. | Clay | 602 | Surface | 2180 | | 30160 | 3160 | 840 | 24400 | 720 | 4040 | 0 - 6 |
| | | 603 | Subsurface | 7440 | | 25720 | 4040 | 1480 | 55560 | 1520 | 10280 | 6 - 16 |
| | | 604 | Subsoil | 26220 | | 18840 | 3240 | | | 2100 | 26580 | 17 - 40 |
| N.E., N.W., N.E., 26, 2 N., 6 E. 3rd P.M. | Clay | 605 | Surface | 2380 | | 28500 | 2820 | 800 | 25100 | 640 | 3540 | 0 - 6 |
| | | 606 | Subsurface | 7280 | | 27240 | 4200 | 1480 | 49960 | 1040 | 7880 | 6 - 16 |
| | | 607 | Subsoil | 24240 | | 19620 | 3420 | | 87060 | 1620 | 23820 | 16 - 40 |
| N.E., N.E., S.W., 20, 1 N., 1 E. 3rd P.M. | Marion | 608 | Surface | 1560 | | 25920 | 2680 | 960 | 26120 | 720 | 3740 | 0 - 7 |
| | | 609 | Subsurface | 6560 | | 26480 | 3120 | 1480 | 56800 | 1320 | 10480 | 7 - 15 |
| | | 610 | Subsoil | 6780 | | 23760 | 3360 | 2760 | 95760 | 2220 | 24420 | 16 - 40 |
| N.E., N.E., N.E., 13, 3 N., 3 W. 3rd P.M. | Clinton | 696 | Surface | 920 | | 30040 | 2880 | 760 | 24840 | 700 | 3300 | 0 - 6 |
| | | 697 | Subsurface | 6160 | | 22960 | 2560 | 1160 | 57440 | 1080 | 7080 | 6 - 18 |
| | | 698 | Subsoil | 6000 | | 22620 | 3120 | 3000 | 78180 | 2940 | 30240 | 19 - 40 |
| S.W., S.E., N.W., 21, 3 S., 4 E. 3rd P.M. | Jefferson | 1142 | Surface | 1480 | | 26360 | 2860 | 1000 | 24080 | 680 | 4060 | 0 - 7 |
| | | 1143 | Subsurface | 8560 | | 30280 | 2760 | 2000 | 54440 | 1360 | 9800 | 7 - 24 |
| | | 1144 | Subsoil | 26520 | | 24060 | 2640 | 2580 | 87060 | 1620 | 26880 | 24 - 40 |
| S.W., S.W., N.E., 16, 1 N., 3 E. 3rd P.M. | Marion | 1157 | Surface | 860 | | 31180 | 3140 | 940 | 25320 | 780 | 4220 | 0 - 7 |
| | | 1158 | Subsurface | 6960 | | 28040 | 3880 | 1720 | 56280 | 1320 | 10160 | 7 - 18 |
| | | 1159 | Subsoil | 22860 | | 27180 | 3840 | 2760 | 84600 | 2160 | 27180 | 20 - 40 |
| S.W., N.E., S.W., 5, 4 S., 4 E, 3rd P.M. | Jefferson | 1160 | Surface | 1120 | | 26440 | 2480 | 940 | 23380 | 640 | 4480 | 0 - 7 |
| | | 1161 | Subsurface | 8120 | | 21480 | 2600 | 1720 | 53520 | 1000 | 11120 | 7 - 26 |
| | | 1162 | Subsoil | 24060 | | 23520 | 3000 | 3060 | 93660 | 1740 | 24720 | 28 - 40 |

ILLINOIS SOIL TYPE No. 330: LOWER ILLINOISAN GLACIATION; GRAY SILT LOAM ON TIGHT CLAY; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| S.E., S.W., S.W., 5, 4 S. 4 E. 3rd P.M. | Jefferson | 1163 | Surface | 900 | | 31080 | 3500 | 900 | 24780 | 700 | 3760 | 0 - 7 |
| | | 1164 | Subsurface | 7320 | | 25040 | 2880 | 1920 | 54000 | 1040 | 8760 | 7 - 24 |
| | | 1165 | Subsoil | 29460 | | 16500 | 3060 | 2520 | 84300 | 1680 | 25140 | 26 - 40 |
| N.E., S.E., N.W., 36, 1 S , 7 E., 3rd P.M. | Wayne | 1850 | Surface | 560 | | 27780 | 2540 | 760 | 23120 | 700 | 5080 | 0 - 7 |
| | | 1851 | Subsurface | 2680 | | 30160 | 3120 | 1320 | 49800 | 1200 | 11000 | 7 - 16 |
| | | 1852 | Subsoil | 23100 | | 15000 | 2580 | 1800 | 81540 | 1620 | 26520 | 18 - 40 |
| N.W., S.E., N.E., 18, 8 S., 2 E. 3rd P.M. | Williamson | 1955 | Surface | 1380 | | 34780 | 2660 | 760 | 25300 | 700 | 6900 | 0 - 7 |
| | | 1956 | Subsurface | 6000 | | 42320 | 3440 | 1360 | 54320 | 1160 | 16200 | 7 - 16 |
| | | 1957 | Subsoil | 24120 | | 40560 | 3120 | 1800 | 90180 | 1680 | 29760 | 18 - 40 |
| N.E., S.E., N.W., 17, 8 S., 2 E. 3rd P.M. | Williamson | 1958 | Surface | 1580 | | 29980 | 2340 | 860 | 26000 | 660 | 4980 | 0 - 7 |
| | | 1959 | Subsurface | 5520 | | 36400 | 2760 | 1200 | 54120 | 1080 | 9920 | 7 - 16 |
| | | 1960 | Subsoil | 27360 | | 43440 | 3600 | 1800 | 88320 | 1740 | 29640 | 18 - 40 |

ILLINOIS SOIL TYPE NO. 426: MIDDLE ILLINOISAN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.W., N.W., S.E., 14, 17 N., 10 W. 3rd P.M. | Cass | 533 | Surface | | 1000 | 67020 | 4980 | 1180 | 18440 | 900 | 8440 | 0 - 7 |
| | | 534 | Subsurface | | 2000 | 80080 | 5880 | 1960 | 34680 | 1400 | 16920 | 7 - 16<br>7 - 18 |
| | | 535 | Subsoil | | 86000 | 25560 | 2100 | 2940 | 61440 | 2220 | 24600 | 16 - 40<br>18 - 42 |
| S.W., S.W., S.E., 11, 17 N., 10 W. 3rd P.M. | Cass | 536 | Surface | | 18500 | 51720 | 4820 | 1360 | 33920 | 1180 | 7760 | 0 - 7 |
| | | 537 | Subsurface | | 28330 | 57200 | 5280 | 2200 | 66840 | 1560 | 14760 | 7 - 21 |
| | | 538 | Subsoil | | 712000 | 22320 | 2100 | 3000 | 89280 | 2280 | 16860 | 24 - 48 |
| N.E., S.W., N.W., 15, 17 N., 10 W. 3rd P.M. | Cass | 540 | Surface | 40 | | 57380 | 4920 | 1180 | 32920 | 980 | 6640 | 0 - 7 |
| | | 541 | Subsurface | 40 | | 81920 | 6880 | 1800 | 65360 | 1400 | 15200 | 7 - 20 |
| | | 542 | Subsoil | | 394000 | 32040 | 2400 | 2640 | 89940 | 2280 | 20340 | 22 - 46 |
| N.E., S.E., S.E., 33, 20 N., 2 W. 3rd P.M. | Logan | 546 | Surface | 40 | | 52660 | 4220 | 1160 | 34640 | 860 | 7740 | 0 - 8 |
| | | 547 | Subsurface | 40 | | 72720 | 6200 | 1720 | 72400 | 1400 | 16040 | 8 - 18<br>8 - 21 |
| | | 548 | Subsoil | 120 | | 28800 | 3240 | 2280 | 105060 | 2100 | 28500 | 18 - 42<br>23 - 47 |
| N.E., N.E., S.W., 21, 15 N., 6 W. 3rd P.M. | Sangamon | 804 | Surface | 80 | | 54360 | 4240 | 1260 | 27620 | 1000 | 8740 | 0 - 7 |
| | | 805 | Subsurface | 120 | | 74080 | 6320 | 1760 | 43960 | 1720 | 18120 | 7 - 18 |
| | | 806 | Subsoil | 480 | | 41760 | 4620 | 2280 | 63660 | 2160 | 32780 | 20 - 40 |
| S.W., N.W., S.E., 28, 13 N., 7 W. 3rd P.M. | Sangamon | 816 | Surface | 60 | | 56300 | 4080 | 1100 | 31260 | 980 | 6660 | 0 - 7 |
| | | 817 | Subsurface | 120 | | 62040 | 5040 | 1880 | 53040 | 1800 | 15280 | 7 - 18 |
| | | 818 | Subsoil | 360 | | 40380 | 4200 | 2880 | 66900 | 2580 | 32700 | 20 - 40 |

ILLINOIS SOIL TYPE No. 426: MIDDLE ILLINOISAN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.E., N.E., N.E., 26, 13 N., 6 W. 3rd P.M. | Sangamon | 819 | Surface | 40 | | 72120 | 5620 | 1220 | 31500 | 1160 | 8080 | 0 - 7 |
| | | 820 | Subsurface | 80 | | 90000 | 6600 | 1560 | 63600 | 1320 | 16360 | 7 - 18 |
| | | 821 | Subsoil | 60 | | 34620 | 3600 | 2160 | 93840 | 1740 | 27060 | 20 - 40 |
| N.E., N.E., N.E., 10, 13 N., 2 W. 3rd P.M. | Christian | 838 | Surface | 120 | | 67080 | 5120 | 1240 | 32760 | 860 | 8200 | 0 - 7 |
| | | 839 | Subsurface | 80 | | 93760 | 7480 | 2080 | 66360 | 1480 | 16000 | 7 - 18 |
| | | 840 | Subsoil | 60 | | 37680 | 4260 | 2460 | 89880 | 1860 | 28440 | 22 - 40 |
| S.E., N. W., S.W., 26, 13 N., 7 W. 3rd P.M. | Sangamon | 888 | Surface | 100 | | 38440 | 3220 | 1300 | 37540 | 780 | 8940 | 0 - 7 |
| | | 889 | Subsurface | 160 | | 54240 | 5480 | 2520 | 73960 | 1440 | 19080 | 7 - 16 |
| | | 890 | Subsoil | 180 | | 32040 | 4140 | 3120 | 112260 | 2160 | 29640 | 18 - 40 |
| N.W., N.W., S.E., 1, 13 N., 7 W. 3rd P.M. | Sangamon | 1937 | Surface | 40 | | 41200 | 3460 | 920 | 37080 | 860 | 7240 | 0 - 7 |
| | | 1938 | Subsurface | 120 | | 46080 | 4200 | 1840 | 74080 | 1400 | 17640 | 7 - 18 |
| | | 1939 | Subsoil | 180 | | 30420 | 3360 | 2700 | 109920 | 2220 | 32880 | 20 - 40 |
| N.W., N.W., S.E., 1, 13 N., 7 W. 3rd P.M. | Sangamon | 1940 | Surface | 40 | | 41260 | 3340 | 920 | 36980 | 780 | 7600 | 0 - 7 |
| | | 1941 | Subsurface | 120 | | 49440 | 4480 | 1760 | 74160 | 1400 | 17840 | 7 - 18 |
| | | 1942 | Subsoil | 180 | | 34740 | 3780 | 3000 | 108300 | 2160 | 33540 | 20 - 40 |

ILLINOIS SOIL TYPE NO. 526: UPPER ILLINOISAN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.E., S.E., 31, 11 N., 2 E. 4th P.M. | Warren | 582 | Surface | 60 | | 75220 | 5320 | 1560 | 29980 | 1460 | 4980 | 0 - 7 |
| | | 583 | Subsurface | 120 | | 85200 | 6920 | 2240 | 58280 | 2000 | 10680 | 7 - 21 |
| | | 584 | Subsoil | | 83500 | 25800 | 2400 | 3360 | 94380 | 3420 | 17940 | 24 - 48 |
| S.W., S.W., S.E., 16, 14 N., 1 E. 4th P.M. | Henry | 780 | Surface | 120 | | 84220 | 5920 | 1200 | 32380 | 1160 | 9260 | 0 - 7 |
| | | 781 | Subsurface | 120 | | 104640 | 8240 | 2120 | 62720 | 1960 | 18760 | 7 - 20 |
| | | 782 | Subsoil | 720 | | 34980 | 4200 | 2520 | 99240 | 2220 | 30660 | 22 - 40 |
| S.E., S.W., N.E., 16, 14 N., 1 W. 4th P.M. | Mercer | 783 | Surface | 60 | | 61000 | 4840 | 1160 | 33680 | 1060 | 8820 | 0 - 7 |
| | | 784 | Subsurface | 120 | | 70760 | 6360 | 2000 | 66000 | 1800 | 18400 | 7 - 20 |
| | | 785 | Subsoil | 720 | | 18720 | 3360 | 2760 | 98820 | 2820 | 30720 | 22 - 40 |
| S.E., S.E., N.E., 9, 1 S., 8 W. 4th P.M. | Adams | 789 | Surface | 60 | | 47760 | 3580 | 1060 | 32120 | 800 | 7140 | 0 - 7 |
| | | 790 | Subsurface | 120 | | 71440 | 4920 | 1920 | 66120 | 2000 | 14800 | 7 - 22 |
| | | 791 | Subsoil | 360 | | 24060 | 3300 | 2940 | 96960 | 2700 | 27060 | 26 - 40 |
| N.E., N.E., N.W., 22, 9 N., 4 E., 4th P.M. | Knox | 1050 | Surface | 120 | | 52580 | 4500 | 1040 | 35840 | 1000 | 7640 | 0 - 7 |
| | | 1051 | Subsurface | 120 | | 69080 | 5680 | 2240 | 73360 | 1600 | 16520 | 7 - 18 |
| | | 1052 | Subsoil | 840 | | 30960 | 3480 | 2400 | 106740 | 2160 | 28560 | 20 - 40 |
| N.W., S.E., N.W., 33, 10 N., 3 W. 4th P.M. | Knox | 1056 | Surface | 60 | | 63420 | 4700 | 1340 | 34260 | 1180 | 7120 | 0 - 7 |
| | | 1057 | Subsurface | 200 | | 83600 | 6080 | 2120 | 65240 | 1760 | 15560 | 7 - 18 |
| | | 1058 | Subsoil | 300 | | 42000 | 3240 | 3480 | 100620 | 2640 | 30780 | 20 - 40 |
| S.W., S.E., S.E., 19, 10 N., 4 E. 4th P.M. | Knox | 1059 | Surface | 20 | | 65180 | 4800 | 1100 | 33560 | 1020 | 9060 | 0 - 7 |
| | | 1060 | Subsurface | 40 | | 91000 | 6760 | 1800 | 62520 | 1720 | 18520 | 7 - 18 |
| | | 1061 | Subsoil | 240 | | 39660 | 3840 | 2040 | 94500 | 1860 | 28920 | 20 - 40 |
| W.N.W., S.W., 31, 11 N., 1 E. 4th P.M. | Knox | 1139 | Surface | 40 | | 64960 | 5020 | 1160 | 31700 | 1000 | 6880 | 0 - 7 |
| | | 1140 | Subsurface | 80 | | 93440 | 6840 | 2280 | 64320 | 1640 | 14920 | 7 - 20 |
| | | 1141 | Subsoil | 60 | | 37140 | 3720 | 2820 | 97380 | 2700 | 25920 | 22 - 40 |

ILLINOIS SOIL TYPE No. 626: PRE-IOWAN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.W., S.E., N.E., 23, 26 N., 9 E. 4th P.M. | Winnebago | 933 | Surface | 140 | | 49560 | 4080 | 1220 | 34860 | 1120 | 8200 | 0 - 7 |
| | | 934 | Subsurface | 1000 | | 44360 | 4040 | 1760 | 70720 | 1320 | 17920 | 7 - 18 |
| | | 935 | Subsoil | 1260 | | 30900 | 3420 | 2880 | 101040 | 2580 | 30120 | 20 - 40 |
| S.W., S.E., N.E., 14,, 26 N., 7 E. 4th P.M. | Stephenson | 942 | Surface | 100 | | 39760 | 3740 | 1020 | 35180 | 900 | 8040 | 0 - 7 |
| | | 943 | Subsurface | 760 | | 52000 | 4480 | 1760 | 69920 | 1360 | 17920 | 7 - 18 |
| | | 944 | Subsoil | 1380 | | 32760 | 3240 | 2820 | 98340 | 2700 | 30660 | 20 - 40 |
| S.E., S.E., N.W., 34, 26 N., 7 E. 4th P.M. | Stephenson | 945 | Surface | 100 | | 52040 | 4480 | 1280 | 36360 | 1240 | 8080 | 0 - 7 |
| | | 946 | Subsurface | 280 | | 52040 | 4600 | 2160 | 71840 | 1960 | 19000 | 7 - 18 |
| | | 947 | Subsoil | 1500 | | 26520 | 2940 | 3600 | 100380 | 3540 | 32280 | 20 - 40 |
| N.E., S.E., N.E., 5, 25 N., 7 E. 4th P.M. | Carroll | 948 | Surface | 100 | | 61880 | 4760 | 1320 | 33320 | 1220 | 9100 | 0 - 7 |
| | | 949 | Subsurface | 680 | | 56400 | 5480 | 1920 | 71280 | 1960 | 19760 | 7 - 18 |
| | | 950 | Subsoil | 2400 | | 21420 | 2820 | 3420 | 99000 | 2940 | 27000 | 20 - 40 |
| N.W., N.E., N.W., 20, 26 N., 10 E. 4th P.M. | Winnebago | 1220 | Surface | 140 | | 46100 | 4340 | 1220 | 35780 | 1100 | 7160 | 0 - 7 |
| | | 1221 | Subsurface | 400 | | 44320 | 4960 | 2320 | 74520 | 1720 | 15600 | 7 - 16 |
| | | 1222 | Subsoil | 1740 | | 17040 | 7680 | 3600 | 108600 | 3240 | 28440 | 18 - 40 |
| E., N.E., S.E., 3, 25 N., 10 E. 4th P.M. | Ogle | 1949 | Surface | 60 | | 45840 | 4340 | 1080 | 36560 | 1020 | 7080 | 0 - 7 |
| | | 1950 | Subsurface | 280 | | 44960 | 4320 | 2440 | 75960 | 1560 | 15640 | 7 - 16 |
| | | 1951 | Subsoil | 1620 | | 27960 | 3540 | 3960 | 108360 | 3120 | 27660 | 18 - 40 |

ILLINOIS SOIL TYPE NO. 726: IOWAN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.E., N.E., N.E., 28, 44 N., 2 E. 3rd P.M. | Winnebago | 1239 | Surface | 100 | | 56140 | 4340 | 1160 | 36260 | 960 | 7320 | 0 - 7 |
| | | 1240 | Subsurface | 600 | | 47000 | 4000 | 1880 | 74360 | 1520 | 16880 | 7 - 16 |
| | | 1241 | Subsoil | 6420 | | 41880 | 3300 | 3120 | 99480 | 2640 | 27480 | 18 - 40 |
| S.E., N.W., S.W., 27, 23 N., 10 E. 4th P.M. | Ogle | 1946 | Surface | 40 | | 58080 | 4720 | 1240 | 31420 | 1140 | 6300 | 0 - 7 |
| | | 1947 | Subsurface | 240 | | 53280 | 4760 | 1880 | 62440 | 1560 | 13280 | 7 - 18 |
| | | 1948 | Subsoil | 420 | | 23940 | 2820 | 2460 | 100140 | 2100 | 25020 | 20 - 40 |
| N.W., N.W., N.W., 14, 21 N., 7 E. 4th P.M. | Whiteside | 2243 | Surface | 120 | | 50640 | 4500 | 1160 | 32320 | 1020 | 7320 | 0 - 7 |
| | | 2244 | Subsurface | 360 | | 54360 | 5400 | 1960 | 66080 | 1400 | 15720 | 7 - 16 |
| | | 2245 | Subsoil | 540 | | 29820 | 4140 | 2880 | 102780 | 2940 | 29820 | 18 - 40 |
| S.W., S.W., S.W., 26, 22 N., 7 E. 4th P.M. | Whiteside | 2246 | Surface | 100 | | 68880 | 6080 | 1300 | 31840 | 1240 | 8800 | 0 - 7 |
| | | 2247 | Subsurface | 240 | | 73800 | 6400 | 2040 | 62000 | 1640 | 17840 | 7 - 16 |
| | | 2248 | Subsoil | 360 | | 32220 | 3900 | 2640 | 96720 | 1800 | 29820 | 18 - 40 |

ILLINOIS SOIL TYPE No. 1126: EARLY WISCONSIN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.E., N.W., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 59 | Surface | 60 | | 70400 | 5340 | 1120 | 36780 | 1120 | 7940 | 0 - 6 |
| | | 60 | Subsurface | 80 | | 87240 | 6920 | 1760 | 71320 | 1640 | 15920 | 6 - 18 |
| | | 61 | Subsoil | 60 | | 28440 | 3360 | 3180 | 115620 | 2640 | 27600 | 22 - 46 |
| N.E., N.W., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 119 | Surface | 100 | | 64740 | 4920 | 1120 | 34320 | 860 | 7860 | 0 - 6 |
| | | 120 | Subsurface | 80 | | 97520 | 7520 | 2000 | 69680 | 1480 | 16240 | 6 - 18 |
| | | 121 | Subsoil | | 7500 | 40020 | 3900 | 2400 | 104640 | 1680 | 30000 | 22 - 46 |
| N.E., N.W., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 179 | Surface | 40 | | 55620 | 4840 | 1080 | 33440 | 1060 | 7880 | 0 - 6 |
| | | 180 | Subsurface | 80 | | 65680 | 6440 | 1720 | 68520 | 1560 | 17040 | 6 - 17 |
| | | 181 | Subsoil | | 149000 | 28320 | 3480 | 2520 | 102420 | 2520 | 27960 | 20 - 44 |
| N.W., N.E., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 239 | Surface | 80 | | 51920 | 4500 | 1060 | 33940 | 980 | 6280 | 0 - 6 |
| | | 240 | Subsurface | 120 | | 73880 | 6520 | 1920 | 67640 | 1760 | 14560 | 6 - 17 |
| | | 241 | Subsoil | 60 | | 28920 | 3900 | 2040 | 102720 | 1440 | 26340 | 19 - 43 |
| N.W., N.E., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 299 | Surface | 60 | | 58280 | 4840 | 1140 | 34340 | 1060 | 8360 | 0 - 6 |
| | | 300 | Subsurface | 80 | | 78080 | 6960 | 1760 | 72200 | 1680 | 18280 | 6 - 16 |
| | | 301 | Subsoil | | 547000 | 25380 | 3180 | 1860 | 136080 | 1440 | 36660 | 18 - 42 |
| N.W., N.E., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 359 | Surface | 40 | | 57240 | 4800 | 1160 | 35260 | 1000 | 7980 | 0 - 6 |
| | | 360 | Subsurface | 80 | | 87800 | 7120 | 2040 | 69560 | 1800 | 16560 | 6 - 18 |
| | | 361 | Subsoil | 60 | | 33300 | 4200 | 2220 | 115020 | 2160 | 28860 | 20 - 44 |
| N.W., N.E., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 419 | Surface | 40 | | 60860 | 5160 | 1260 | 34260 | 900 | 7120 | 0 - 6 |
| | | 420 | Subsurface | 40 | | 76680 | 6440 | 1760 | 69480 | 1440 | 14440 | 6 - 18 |
| | | 421 | Subsoil | 60 | | 32760 | 3720 | 2700 | 105840 | 1920 | 26520 | 20 - 44 |

ILLINOIS SOIL TYPE NO. 1126: EARLY WISCONSIN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| N.E., N.W., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 467 | Surface | 40 | | 50840 | 3980 | 1080 | 36640 | 920 | 7880 | 0 - 6 |
| | | 468 | Subsurface | 80 | | 81880 | 7160 | 1960 | 77400 | 1800 | 17160 | 6 - 17 |
| | | 469 | Subsoil | 60 | | 13020 | 2760 | 2760 | 127260 | 2700 | 29760 | 20 - 44 |
| N.W., N.W., S.E., 18, 19 N., 9 E. 3rd P.M. | Champaign | 470 | Surface | 80 | | 46440 | 4020 | 1020 | 35260 | 900 | 7400 | 0 - 6 |
| | | 471 | Subsurface | 120 | | 82160 | 7080 | 1960 | 69440 | 1680 | 15800 | 6 - 17 |
| | | 472 | Subsoil | 60 | | 31380 | 3840 | 2760 | 109380 | 2520 | 28500 | 20 - 44 |
| W., S.E., S.E., 35, 25 N., 7 E. 3rd P.M. | Ford | 512 | Surface | 60 | | 69220 | 5580 | 1040 | 36220 | 840 | 9860 | 0 - 6 |
| | | 513 | Subsurface | 80 | | 86560 | 7200 | 1600 | 72160 | 1240 | 19360 | 6 - 21 |
| | | 514 | Subsoil | | 38000 | 27780 | 3120 | 1920 | 115320 | 1440 | 36840 | 21 - 43 |
| S., S.E., S.E., 33, 25 N., 7 E. 3rd P.M. | Ford | 516 | Surface | 40 | | 45640 | 4060 | 1340 | 37180 | 1100 | 8260 | 0 - 6 |
| | | 517 | Subsurface | 120 | | 62360 | 4160 | 2360 | 69240 | 1760 | 17120 | 6 - 24 |
| | | 518 | Subsoil | | 72500 | 28560 | 2400 | 2700 | 118680 | 2160 | 36900 | 24 - 48 |
| N.E., N.E., S.E., 1, 23 N., 1 E. 3rd P.M. | McLean | 519 | Surface | 120 | | 72900 | 5840 | 1220 | 33480 | 1180 | 8320 | 0 - 6 |
| | | 520 | Subsurface | 40 | | 84400 | 6800 | 2080 | 67360 | 1640 | 17320 | 6 - 17 |
| | | 521 | Subsoil | 180 | | 21180 | 3300 | 2160 | 107580 | 1740 | 28140 | 18 - 42 |
| N.W. 40, S.W.¼, 25, 24 N., 2 E. 3rd P.M. | McLean | 522 | Surface | 80 | | 72700 | 6340 | 1260 | 31980 | 1000 | 8420 | 0 - 6 |
| | | 523 | Subsurface | 80 | | 94160 | 6840 | 1920 | 66520 | 1120 | 18720 | 6 - 20<br>6 - 16 |
| | | 524 | Subsoil | | 17500 | 42300 | 2940 | 3360 | 99600 | 2220 | 30000 | 24 - 48<br>17 - 41 |
| N., N.W., S.E., 12, 22 N., 1 E. 3rd P.M. | McLean | 552 | Surface | | 1670 | 76080 | 6320 | 1460 | 35580 | 1180 | 8000 | 0 - 7 |
| | | 553 | Subsurface | | 1670 | 82840 | 6880 | 1960 | 69920 | 1560 | 15680 | 7 - 18<br>7 - 22 |
| | | 554 | Subsoil | | 177000 | 22380 | 2280 | 2880 | 104280 | 2580 | 25080 | 22 - 46<br>24 - 48 |

ILLINOIS SOIL TYPE No. 1126: EARLY WISCONSIN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE.

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.W., N.E., N.E., 32, 23 N., 4 W. 3rd P.M. | Tazewell | 649 | Surface | 20 | | 51980 | 4300 | 1160 | 36000 | 860 | 8200 | 0 - 7 |
| | | 650 | Subsurface | 40 | | 77440 | 6000 | 2160 | 72200 | 1440 | 17120 | 7 - 18 |
| | | 651 | Subsoil | 360 | | 46560 | 4260 | 2880 | 111360 | 2280 | 27480 | 20 - 40 |
| N.W., S.E., N.E., 32, 20 N., 6 E. 3rd P.M. | Piatt | 960 | Surface | 60 | | 46180 | 4200 | 1100 | 35680 | 940 | 8980 | 0 - 7 |
| | | 961 | Subsurface | 80 | | 62520 | 5880 | 1920 | 71600 | 1480 | 19200 | 7 - 18 |
| | | 962 | Subsoil | 120 | | 32340 | 3240 | 2460 | 99060 | 2040 | 32640 | 20 - 40 |
| S.W., N.W., S.W., 9, 22 N., 3 E. 3rd P.M. | McLean | 1289 | Surface | 80 | | 50060 | 4280 | 1060 | 34820 | 900 | 8340 | 0 - 7 |
| | | 1290 | Subsurface | 160 | | 63760 | 6000 | 1680 | 70720 | 1600 | 17400 | 7-17 - 18 |
| | | 1291 | Subsoil | | 23500 | 36780 | 3720 | 3000 | 106200 | 1980 | 30900 | 20 - 40 |
| S.W., N.W., S.W., 17, 22 N., 2 E. 3rd P.M. | McLean | 1292 | Surface | 60 | | 47460 | 4340 | 1260 | 42900 | 920 | 8580 | 0 - 7 |
| | | 1293 | Subsurface | 240 | | 66560 | 5680 | 2360 | 66400 | 1640 | 19360 | 7 - 17 |
| | | 1294 | Subsoil | | 38500 | 29100 | 3180 | 2880 | 104640 | 1920 | 29580 | 20 - 40 |
| N.W., N.W., N.W., 29, 22 N., 6 E. 3rd P.M. | McLean | 1295 | Surface | 60 | | 49000 | 4140 | 1160 | 35380 | 860 | 8760 | 0 - 7 |
| | | 1296 | Subsurface | 120 | | 66160 | 6160 | 1880 | 68720 | 1480 | 18160 | 7 - 18 |
| | | 1297 | Subsoil | | 131000 | 33060 | 3240 | 1920 | 128100 | 1620 | 42000 | 20 - 40 |
| S.W., S.W., S.W., 22, 23 N., 5 E. 3rd P.M. | McLean | 1301 | Surface | 100 | | 50440 | 4360 | 1180 | 36700 | 1100 | 9360 | 0 - 7 |
| | | 1302 | Subsurface | 160 | | 84600 | 7800 | 2240 | 72200 | 2080 | 20040 | 7 - 18 |
| | | 1303 | Subsoil | 120 | | 44220 | 4620 | 2460 | 104940 | 2220 | 30660 | 20 - 40 |
| N.W., N.W., N.E., 17, 23 N., 1 E. 3rd P.M. | McLean | 1304 | Surface | 80 | | 46880 | 4180 | 1340 | 37680 | 1240 | 9660 | 0 - 7 |
| | | 1305 | Subsurface | 120 | | 70960 | 6760 | 2520 | 77120 | 2240 | 18520 | 7 - 18 |
| | | 1306 | Subsoil | 1080 | | 36300 | 4320 | 3000 | | 2820 | 31140 | 20 - 40 |
| S.W., S.W., S E., 29, 24 N., 1 W. 3rd P.M. | McLean | 1307 | Surface | 60 | | 45060 | 4080 | 1340 | 38520 | 1280 | 9740 | 0 - 7 |
| | | 1308 | Subsurface | 120 | | 60960 | 6000 | 2040 | 77000 | 1920 | 18960 | 7 - 18 |
| | | 1309 | Subsoil | 600 | | 30420 | 3600 | 2520 | 109080 | 2280 | 31800 | 20 - 40 |

ILLINOIS SOIL TYPE NO. 1126: EARLY WISCONSIN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| N.W., N.W., N.W., 22, 24 N., 1 E. 3rd P.M. | McLean | 1310 | Surface | 40 | | 56900 | 4660 | 1080 | 33740 | 940 | 8080 | 0 - 7 |
| | | 1311 | Subsurface | 80 | | 62400 | 5440 | 2200 | 66800 | 1840 | 17120 | 7 - 18 |
| | | 1312 | Subsoil | 120 | | 27600 | 3540 | 3180 | | 1980 | 34140 | 20 - 40 |
| N.W., S.W., N.W., 33, 30 N., 9 E. 3rd P.M. | Kankakee | 1620 | Surface | 20 | | 84340 | 6760 | 1280 | 40000 | 1200 | 11280 | 0 - 7 |
| | | 1621 | Subsurface | 40 | | 81080 | 6640 | 1840 | 86760 | 1520 | 23760 | 7 - 18 |
| | | 1622 | Subsoil | | 275000 | 22680 | 3360 | 2340 | 160380 | 1980 | 58140 | 20 - 40 |
| N.E., N.E., N.E., 8, 29 N., 10 E. 3rd P.M. | Kankakee | 1623 | Surface | 20 | | 85940 | 7520 | 1440 | 43100 | 1260 | 11480 | 0 - 7 |
| | | 1624 | Subsurface | 40 | | 59720 | 5760 | 1680 | 92720 | 1520 | 27400 | 7 - 18 |
| | | 1625 | Subsoil | | 165500 | 27180 | 3000 | 2160 | 161340 | 2040 | 52440 | 20 - 40 |
| S.W., S.W., S.E., 23, 26 N., 14 W., 2nd P.M. | Iroquois | 1659 | Surface | 40 | | 63220 | 5220 | 1000 | 41300 | 960 | 12960 | 0 - 7 |
| | | 1660 | Subsurface | 40 | | 87440 | 7440 | 1960 | 85560 | 1520 | 26040 | 7 - 18 |
| | | 1661 | Subsoil | | 203500 | 28080 | 3960 | 2340 | 154260 | 1740 | 59040 | 20 - 40 |
| S.W., S.W., S.W., 28, 31 N., 3 E. 3rd P.M. | LaSalle | 2471 | Surface | 40 | | 73220 | 6000 | 1100 | 33120 | 1060 | 9640 | 0 - 7 |
| | | 2472 | Subsurface | 40 | | 83960 | 7280 | 2080 | 70360 | 1640 | 17280 | 7 - 18 |
| | | 2473 | Subsoil | | 34000 | 32640 | 3360 | 3480 | 107880 | 2040 | 31200 | 20 - 40 |
| N.W., S.W., N.W., 22, 35 N., 2 E. 3rd P.M. | LaSalle | 2495 | Surface | 40 | | 55940 | 4860 | 980 | 32540 | 940 | 7920 | 0 - 7 |
| | | 2496 | Subsurface | 120 | | 54160 | 5000 | 2520 | 67600 | 1720 | 15640 | 7 - 18 |
| | | 2497 | Subsoil | 660 | | 26940 | 3360 | 3000 | 102480 | 2640 | 30240 | 20 - 40 |
| W., S.E., S.E., 27, 40 N., 4 E., 3rd P.M. | DeKalb | 2539 | Surface | 40 | | 72420 | 6080 | 1620 | 34180 | 1500 | 8280 | 0 - 7 |
| | | 2540 | Subsurface | | 1000 | 91480 | 7600 | 2280 | 71840 | 2320 | 16320 | 7 - 18 |
| | | 2541 | Subsoil | | 12500 | 23340 | 2340 | 3000 | 109080 | 2640 | 28620 | 20 - 40 |
| S.W., S.W., S.W., 20, 28 N., 6 E. 3rd P.M. | Livingston | 2616 | Surface | 20 | | 72960 | 5940 | 1160 | 43120 | 1180 | 13220 | 0 - 7 |
| | | 2617 | Subsurface | | 2330 | 80400 | 7360 | 1960 | 85360 | 1760 | 29000 | 7 - 18 |
| | | 2618 | Subsoil | | 107000 | 30720 | 3120 | 2460 | 177480 | 2160 | 68820 | 20 - 40 |

ILLINOIS SOIL TYPE NO. 1026: LATE WISCONSIN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.W., S.W., S.W., 13, 38 N., 9 E. 3rd P.M. | DuPage | 678 | Surface | 80 | | 70800 | 5920 | 1380 | 41320 | 1180 | 9540 | 0 - 6 |
| | | 679 | Subsurface | 160 | | 100320 | 9080 | 2640 | 82200 | 2080 | 17960 | 6 - 16 |
| | | 680 | Subsoil | | 96500 | 30660 | 4680 | 2520 | 177540 | 2280 | 68340 | 18 - 40 |
| S., N.W., N.W., 35, 46 N., 7 E. 3rd P.M. | McHenry | 921 | Surface | 100 | | 51540 | 4500 | 1320 | 38780 | 1140 | 8260 | 0 - 7 |
| | | 922 | Subsurface | 480 | | 50000 | 4640 | 2000 | 74880 | 1480 | 18840 | 7 - 16 |
| | | 923 | Subsoil | 1080 | | 35700 | 3180 | 3180 | 117960 | 2280 | 31620 | 18 - 40 |
| N.E., S.W., S.E., 2, 45 N., 10 E. 3rd P.M. | Lake | 1253 | Surface | 20 | | 70400 | 5960 | 1400 | 39440 | 1220 | 6380 | 0 - 7 |
| | | 1254 | Subsurface | 40 | | 61760 | 5200 | 1720 | 87680 | 1240 | 19800 | 7 - 16 |
| | | 1255 | Subsoil | | 40500 | 32460 | 4680 | 3000 | 169800 | 2520 | 52200 | 18 - 40 |
| S.E., N.E., S.E., 36, 46 N., 10 E. 3rd P.M. | Lake | 1256 | Surface | 20 | | 115040 | 9740 | 1800 | 52700 | 1600 | 14280 | 0 - 7 |
| | | 1257 | Subsurface | 40 | | 98480 | 8960 | 1960 | 118680 | 1720 | 35320 | 7 - 16 |
| | | 1258 | Subsoil | | 1215500 | 28680 | 4080 | 2460 | 181140 | 2220 | 69180 | 18 - 40 |
| S.E., N.W., N.E., 36, 45 N., 10 E. 3rd P.M. | Lake | 1259 | Surface | 40 | | 84260 | 7140 | 1460 | 49680 | 1300 | 12060 | 0 - 7 |
| | | 1260 | Subsurface | 80 | | 76960 | 5600 | 1720 | 105920 | 1600 | 26760 | 7 - 16 |
| | | 1261 | Subsoil | | 908000 | 35760 | 3360 | 2520 | 168900 | 2100 | 58920 | 18 - 40 |
| S.E., S.E., S.E., 7, 46 N., 12 E. 3rd P.M. | Lake | 1712 | Surface | 60 | | 89380 | 7460 | 1380 | 48860 | 1320 | 9640 | 0 - 7 |
| | | 1713 | Subsurface | 120 | | 73240 | 6480 | 1840 | 105360 | 1640 | 21720 | 7 - 16 |
| | | 1714 | Subsoil | | 662500 | 28980 | 4140 | 2460 | 180000 | 2160 | 69360 | 18 - 40 |
| N.W., N.E., N.E., 4, 43 N., 11 E. 3rd P.M. | Lake | 1715 | Surface | 60 | | 83500 | 7140 | 1480 | 41940 | 1360 | 11840 | 0 - 7 |
| | | 1716 | Subsurface | 120 | | 83440 | 7320 | 2080 | 93520 | 1800 | 26800 | 7 - 16 |
| | | 1717 | Subsoil | | 1370000 | 41640 | 2640 | 2400 | 142920 | 2400 | 56700 | 18 - 40 |

ILLINOIS SOIL TYPE NO. 1026: LATE WISCONSIN GLACIATION; BROWN SILT LOAM; UNDULATING PRAIRIE

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| S.E., N.W., N.W., 25, 44 N., 10 E. 3rd P.M. | Lake | 1718 | Surface | 60 | | 63480 | 5400 | 1180 | 54680 | 1080 | 19400 | 0 - 7 |
| | | 1719 | Subsurface | 120 | | 73880 | 7080 | 1720 | 117440 | 1680 | 45160 | 7 - 16 |
| | | 1720 | Subsoil | | 1028000 | 38760 | 2700 | 2520 | 171960 | 2580 | 78840 | 18 - 40 |
| N.E., N.E., N.E., 17, 45 N., 11 E. 3rd P.M. | Lake | 1721 | Surface | 80 | | 89340 | 7480 | 1280 | 37800 | 1180 | 11520 | 0 - 7 |
| | | 1722 | Subsurface | 160 | | 89200 | 7440 | 2000 | 82120 | 1800 | 21920 | 7 - 16 |
| | | 1723 | Subsoil | | 1233500 | 38640 | 3180 | 2640 | 131040 | 2220 | 42780 | 18 - 40 |

ILLINOIS SOIL TYPE No. 420: MIDDLE ILLINOISAN GLACIATION; BLACK CLAY LOAM; FLAT PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.E., S.E., S.E., 16, 14 N., 6 W. 3rd P.M. | Sangamon | 810 | Surface | 40 | | 67360 | 4760 | 1400 | 31300 | 1380 | 9040 | 0 - 7 |
| | | 811 | Subsurface | 80 | | 90520 | 7120 | 2360 | 65320 | 2040 | 17680 | 7 - 18 |
| | | 812 | Subsoil | 60 | | 31020 | 3780 | 3180 | 90480 | 3120 | 27120 | 22 - 40 |
| N.W., N.E., S.W., 26, 13 N., 7 W., 3rd P.M. | Sangamon | 891 | Surface | 40 | | 58260 | 4460 | 1600 | 35100 | 1380 | 8800 | 0 - 7 |
| | | 892 | Subsurface | 80 | | 75120 | 6080 | 2840 | 69320 | 2360 | 17240 | 7 - 18 |
| | | 893 | Subsoil | | 7000 | 25320 | 2880 | 4200 | 107940 | 3120 | 26220 | 20 - 40 |
| N.E., N.E., N.W., 23, 16 N., 8 W. 3rd P.M. | Sangamon | 1004 | Surface | | 1670 | 72900 | 6200 | 1320 | 31460 | 1320 | 8300 | 0 - 7 |
| | | 1005 | Subsurface | | 11670 | 80640 | 6520 | 2000 | 61400 | 1960 | 16840 | 7 - 20 |
| | | 1006 | Subsoil | | 155500 | 30060 | 3120 | 2880 | 89700 | 2760 | 24840 | 22 - 40 |
| N.W., S.W., S.W., 29, 15 N., 7 W. 3rd P.M. | Sangamon | 1007 | Surface | 40 | | 63700 | 5280 | 1320 | 29440 | 1240 | 8260 | 0 - 7 |
| | | 1008 | Subsurface | 240 | | 70400 | 6000 | 2040 | 60080 | 1960 | 14960 | 7 - 18 |
| | | 1009 | Subsoil | | 44500 | 25500 | 3000 | 2640 | 89520 | 2460 | 24900 | 20 - 40 |
| N.E., N.W., S.E., 21, 15 N., 5 W. 3rd P.M. | Sangamon | 1010 | Surface | | 1000 | 65640 | 5000 | 1680 | 33600 | 1640 | 9260 | 0 - 7 |
| | | 1011 | Subsurface | | 1330 | 80680 | 5640 | 2120 | 70480 | 1920 | 18360 | 7 - 18 |
| | | 1012 | Subsoil | | 68000 | 32160 | 3000 | 2640 | 100980 | 2160 | 25020 | 20 - 40 |
| S.W., S.W., S.W., 31, 17 N., 1 W. 3rd P.M. | Sangamon | 1028 | Surface | | 3330 | 59400 | 5340 | 1360 | 29740 | 1240 | 7940 | 0 - 7 |
| | | 1029 | Subsurface | | 8000 | 65200 | 5920 | 2240 | 55840 | 2000 | 13880 | 7 - 18 |
| | | 1030 | Subsoil | | 666500 | 23340 | 2640 | 3000 | 81540 | 2820 | 21900 | 20 - 40 |
| S.E., N.W., S.W., 28, 11 N., 4 W. 3rd P.M. | Montgomery | 1817 | Surface | 40 | | 73380 | 6820 | 1340 | 32360 | 1320 | 8340 | 0 - 7 |
| | | 1818 | Subsurface | 40 | | 61160 | 6000 | 2200 | 66080 | 2080 | 15680 | 7 - 18 |
| | | 1819 | Subsoil | | 103000 | 22200 | 2700 | 2700 | 104160 | 2760 | 24780 | 20 - 40 |

ILLINOIS SOIL TYPE NO. 520: UPPER ILLINOISAN GLACIATION; BLACK CLAY LOAM; FLAT PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.E., S.E., N.E., 4, 11 N., 1 E. 4th P.M. | Knox | 1122 | Surface | 40 | | 93180 | 7620 | 1780 | 28300 | 1520 | 7260 | 0 - 7 |
| | | 1123 | Subsurface | 40 | | 95240 | 7640 | 2600 | 58000 | 2280 | 14720 | 7 - 20 |
| | | 1124 | Subsoil | | 3860 | 25560 | 2340 | 4020 | 95520 | 3660 | 25200 | 22 - 40 |
| S.W., N.E., S.E., 4, 12 N., 2 E. 4th P.M. | Knox | 1125 | Surface | 40 | | 91720 | 7680 | 1900 | 31120 | 1840 | 9380 | 0 - 7 |
| | | 1126 | Subsurface | 40 | | 79200 | 6840 | 2760 | 65920 | 2520 | 18840 | 7 - 20 |
| | | 1127 | Subsoil | | 310 | 24900 | 2640 | 4080 | 104880 | 3780 | 27840 | 22 - 40 |
| S.E., S.E., N.E., 33, 5 N., 1 W. 4th P.M. | McDonough | 3026 | Surface | | 100 | 84540 | 6320 | 1500 | 31000 | 1480 | 21400 | 0 - 7 |
| | | 3027 | Subsurface | | 120 | 108160 | 7960 | 2600 | 62840 | 2480 | 35240 | 7 - 20 |
| | | 3028 | Subsoil | | 260 | 57600 | 3900 | 3180 | 98100 | 2940 | 53760 | 20 - 40 |
| N.E., S.W., S.E., 32, 6 N., 2 W. 4th P.M. | McDonough | 3029 | Surface | | 70 | 76620 | 5940 | 1580 | 28180 | 1460 | 16180 | 0 - 7 |
| | | 3030 | Subsurface | | 140 | 82480 | 6880 | 2680 | 57160 | 2400 | 32600 | 7 - 20 |
| | | 3031 | Subsoil | | 1270 | 40320 | 3120 | 3420 | 90480 | 3120 | 50580 | 20 - 40 |
| N.W., N.W., N.W., 16, 7 N., 3 W. 4th P.M. | McDonough | 3032 | Surface | | 70 | 73980 | 6240 | 1680 | 29740 | 1580 | 15400 | 0 - 7 |
| | | 3033 | Subsurface | | 180 | 88240 | 7560 | 2800 | 59920 | 2720 | 29720 | 7 - 20 |
| | | 3034 | Subsoil | | 350 | 38340 | 3720 | 3480 | 92100 | 3360 | 47160 | 20 - 40 |

ILLINOIS SOIL TYPE NO. 1120: EARLY WISCONSIN GLACIATION; BLACK CLAY LOAM; FLAT PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES).

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.E., S.E., N.E., 34, 23 N., 4 W. 3rd P.M. | Tazewell | 664 | Surface | | 11500 | 75080 | 6420 | 1880 | 35500 | 1580 | 7720 | 0 - 7 |
| | | 665 | Subsurface | | 47330 | 71440 | 6680 | 3120 | 72080 | 2640 | 16400 | 7 - 20 |
| | | 666 | Subsoil | | 16500 | 26580 | 3720 | 3540 | 109740 | 3000 | 24060 | 24 - 40 |
| N.W., N.W., S.W., 8, 24 N., 3 W. 3rd P.M. | Tazewell | 667 | Surface | | 3500 | 82200 | 7740 | 2200 | 33780 | 1940 | 8320 | 0 - 7 |
| | | 668 | Subsurface | | 6330 | 78240 | 6600 | 3520 | 71720 | 2440 | 14160 | 7 - 27 |
| | | 669 | Subsoil | | 49000 | 27420 | 3540 | 4380 | 107040 | 3660 | 25740 | 28 - 40 |
| N.E., S.E., N.E., 36, 20 N., 9 E. 3rd P.M. | Champaign | 687 | Surface | | 1330 | 102080 | 8040 | 1880 | 36900 | 1840 | 9460 | 0 - 6 |
| | | 688 | Subsurface | | 2000 | 98160 | 7560 | 2800 | 68320 | 2480 | 19320 | 6 - 16 |
| | | 689 | Subsoil | 60 | | 21180 | 2880 | 3660 | 116580 | 3780 | 29400 | 18 - 40 |
| S.E., N.E., S.E., 11, 20 N., 5 E. 3rd P.M. | Piatt | 963 | Surface | | 1330 | 97200 | 8220 | 1760 | 36760 | 1700 | 9120 | 0 - 7 |
| | | 964 | Subsurface | 40 | | 73160 | 6120 | 2480 | 70320 | 2360 | 19840 | 7 - 18 |
| | | 965 | Subsoil | 60 | | 26700 | 2820 | 2940 | 108180 | 2820 | 28680 | 20 - 40 |
| S.E., S.E., S.E., 17, 26 N., 3 E. 3rd P.M. | McLean | 1313 | Surface | | 16830 | 83020 | 7280 | 1960 | 37400 | 1820 | 9800 | 0 - 7 |
| | | 1314 | Subsurface | | 18330 | 77400 | 7160 | 3160 | 77960 | 2640 | 19880 | { 7 - 16 / 7 - 18 |
| | | 1315 | Subsoil | | 331500 | 31740 | 2640 | 3480 | 117360 | 2820 | 29940 | 20 - 40 |
| S.W., S.W., N.W., 33, 22 N., 3 E. 3rd P.M. | McLean | 1316 | Surface | | 137830 | 87380 | 8440 | 2460 | 30180 | 2000 | 7700 | 0 - 7 |
| | | 1317 | Subsurface | | 215000 | 85640 | 8040 | 3360 | 62440 | 2760 | 15440 | 7 - 18 |
| | | 1318 | Subsoil | | 709000 | 26520 | 2760 | 3420 | 97920 | 2700 | 26580 | 20 - 40 |
| N.E., S.E., S.E., 8, 22 N., 5 E. 3rd P.M. | McLean | 1322 | Surface | | 178670 | 94660 | 9180 | 2780 | 30620 | 2620 | 7280 | 0 - 7 |
| | | 1323 | Subsurface | | 239670 | 94800 | 8920 | 4520 | 65480 | 4200 | 14960 | 7 - 18 |
| | | 1324 | Subsoil | | 136000 | 53640 | 4380 | 4500 | 107100 | 4080 | 26520 | 20 - 40 |

Illinois Soil Type No. 1120: Early Wisconsin Glaciation; Black Clay Loam; Flat Prairie

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| N.W., N.W., N.W., 8, 22 N., 5 E. 3rd P.M. | McLean | 1325 | Surface | | 3170 | 75640 | 6980 | 1800 | 34220 | 1740 | 8460 | 0 - 7 |
| | | 1326 | Subsurface | | 13670 | 84800 | 7600 | 3160 | 69000 | 2960 | 16480 | 7 - 18 |
| | | 1327 | Subsoil | | 51500 | 38340 | 3600 | 3540 | 108600 | 3060 | 25860 | 20 - 40 |
| N.E., N.E., N.W., 23, 16 N., 13 W. 2nd P.M. | Edgar | 1496 | Surface | | 1670 | 113080 | 10140 | 2280 | 30000 | 2140 | 7180 | 0 - 7 |
| | | 1497 | Subsurface | 40 | | 81400 | 7320 | 2880 | 70480 | 2480 | 15000 | 7 - 18 |
| | | 1498 | Subsoil | 60 | | 24300 | 3420 | 3780 | 99240 | 3240 | 25320 | 20 - 40 |
| S.W., N.W., N.W., 12, 14 N., 13 W. 2nd P.M. | Edgar | 1502 | Surface | | 1000 | 66300 | 6420 | 1880 | 32400 | 1560 | 9160 | 0 - 7 |
| | | 1503 | Subsurface | 40 | | 68360 | 7280 | 2960 | 62600 | 2400 | 19080 | 7 - 18 |
| | | 1504 | Subsoil | 60 | | 42960 | 4440 | 3420 | 103200 | 2940 | 31740 | 20 - 40 |
| N.W., S.W., N.W., 19, 26 N., 13 W. 2nd P.M. | Iroquois | 1656 | Surface | | 1000 | 81980 | 7320 | 1420 | 48740 | 1260 | 15040 | 0 - 7 |
| | | 1657 | Subsurface | 40 | | 66080 | 5960 | 2040 | 98000 | 1800 | 34040 | 7 - 20 |
| | | 1658 | Subsoil | 60 | | 38520 | 4140 | 3240 | 149100 | 2880 | 53700 | 22 - 40 |

ILLINOIS SOIL TYPE No. 1220: LATE WISCONSIN GLACIATION; BLACK CLAY LOAM; FLAT PRAIRIE. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES).

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.E., N.E., S.W., 23, 38 N., 9 E. 3rd P.M. | Du Page | 684 | Surface | | 2000 | 116640 | 10500 | 2060 | 38060 | 2000 | 10100 | 0 - 6 |
| | | 685 | Subsurface | | 2667 | 162440 | 14800 | 3520 | 76480 | 3040 | 20080 | 6 - 18 |
| | | 686 | Subsoil | | 11000 | 20880 | 3840 | 3480 | 118320 | 3240 | 35160 | 18 - 40 |
| N.E., S.E., N.W., 35, 46 N., 7 E. 3rd P.M. | McHenry | 918 | Surface | 40 | | 82000 | 7300 | 1680 | 36680 | 1380 | 6600 | 0 - 7 |
| | | 919 | Subsurface | 40 | | 46480 | 3400 | 2200 | 81200 | 1800 | 17520 | 7 - 20 |
| | | 920 | Subsoil | 60 | | 28860 | 2520 | 4380 | 132420 | 3900 | 35520 | 24 - 40 |

ILLINOIS SOIL TYPE NO. 135: UNGLACIATED AREA; YELLOW SILT LOAM; ROLLING TIMBER LAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| N.W., N.E., 33, 12 S., 3 E. 3rd P.M. | Johnson | 473 | Surface | 60 | | 17660 | 1840 | 760 | 28180 | 620 | 4880 | 0 - 6 |
| | | 474 | Subsurface | 9240 | | 14680 | 1880 | 2080 | 66640 | 2080 | 16600 | 6 - 25 |
| | | 475 | Subsoil | 19380 | | 7620 | 1620 | 3120 | 97320 | 2880 | 26880 | 26 - 48 |
| N.E., N.E., 9, 13 S., 3 E. 3rd P.M. | Johnson | 477 | Surface | 80 | | 17240 | 1800 | 940 | 30740 | 800 | 4160 | 0 - 6 |
| | | 478 | Subsurface | 4760 | | | 1520 | | | 1920 | 14240 | 6 - 24 |
| | | 479 | Subsoil | 20760 | | 7140 | 2160 | 3240 | 103320 | 1800 | 26220 | 26 - 48 |
| N.W., N.W., 3, 11 S., 9 E. 3rd P.M. | Pope | 900 | Surface | 40 | | 12660 | 1260 | 860 | 35220 | 680 | 6240 | 0 - 7 |
| | | 901 | Subsurface | 1920 | | 12160 | 1720 | 2280 | 73720 | 1920 | 19120 | 7 - 20 |
| | | 902 | Subsoil | 6720 | | 8760 | 2280 | 3360 | 120540 | 2940 | 28680 | 20 - 40 |
| S.E., S.E., S.W., 19, 12 S., 2 E. 3rd P.M. | Johnson | 1360 | Surface | 80 | | 16360 | 1700 | 1000 | 31660 | 980 | 4900 | 0 - 7 |
| | | 1361 | Subsurface | 7400 | | 14160 | 2000 | 2320 | 66040 | 2320 | 16520 | 7 - 18 |
| | | 1362 | Subsoil | 24120 | | 8220 | 1920 | 3720 | 107700 | 3300 | 25380 | 20 - 40 |
| N.E., N.W., S.W., 17. 11 S., 2 E. 3rd P.M. | Johnson | 1363 | Surface | 20 | | 23520 | 2220 | 1000 | 34440 | 820 | 5220 | 0 - 7 |
| | | 1364 | Subsurface | 520 | | 19280 | 2440 | 2120 | 69920 | 1840 | 13240 | 7 - 18 |
| | | 1365 | Subsoil | 21180 | | 13500 | 2180 | 3660 | 110580 | 3240 | 25620 | 20 - 40 |
| N.W., S.E., N.W., 30, 11 S., 3 E. 3rd P. M. | Johnson | 1366 | Surface | 60 | | 20860 | 2040 | 980 | 31980 | 800 | 5020 | 0 - 7 |
| | | 1367 | Subsurface | 2200 | | 19880 | 2280 | 1960 | 65960 | 1760 | 14080 | 7 - 18 |
| | | 1368 | Subsoil | 20760 | | 13320 | 1980 | 3000 | 104940 | 2460 | 23940 | 20 - 40 |
| N.E., N.W., S.E., 36, 11 S., 3 E. 3rd P.M. | Johnson | 1369 | Surface | 20 | | 28300 | 2300 | 940 | 34300 | 740 | 504 0 | 0 - 7 |
| | | 1370 | Subsurface | 2880 | | 19760 | 2320 | 1760 | 72520 | 1720 | 13600 | 7 - 18 |
| | | 1371 | Subsoil | 20880 | | 15840 | 1740 | 3180 | 110460 | 2820 | 24540 | 20 - 40 |

ILLINOIS SOIL TYPE No. 135: UNGLACIATED AREA; YELLOW SILT LOAM; ROLLING TIMBER LAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.W., N.W., S.E., 28, 11 S., 4 E. 3rd P.M. | Johnson | 1372 | Surface | 120 | | 15860 | 1600 | 1040 | 27740 | 900 | 4620 | 0 - 7 |
| | | 1373 | Subsurface | 9360 | | 15280 | 2080 | 2000 | 56440 | 1840 | 12800 | 7 - 18 |
| | | 1374 | Subsoil | 31140 | | 11700 | 1980 | 2520 | 106560 | 2280 | 24840 | 20 - 40 |
| N.W., N.E., S.E., 27, 13 S., 3 E. 3rd P.M. | Johnson | 1375 | Surface | 40 | | 17400 | 1780 | 900 | 28660 | 700 | 4680 | 0 - 7 |
| | | 1376 | Subsurface | 3880 | | 12920 | 1960 | 2120 | 65760 | 1640 | 13480 | 7 - 18 |
| | | 1377 | Subsoil | 22860 | | 10500 | 1860 | 3300 | 92520 | 2400 | 25260 | 20 - 40 |
| S.E., N.W., S.E., 5, 13 S., 4 E. 3rd P.M. | Johnson | 1381 | Surface | 260 | | 22880 | 2360 | 1220 | 28480 | 900 | 4660 | 0 - 7 |
| | | 1382 | Subsurface | 8160 | | 10800 | 2080 | 1920 | 62200 | 1600 | 13000 | 7 - 18 |
| | | 1383 | Subsoil | 28080 | | 9180 | 1920 | 2460 | 97920 | 2400 | 24420 | 20 - 40 |
| S.W., S.E., N.E., 32, 13 S., 2 E. 3rd P.M. | Johnson | 1384 | Surface | 80 | | 19420 | 1920 | 800 | 34520 | 720 | 4880 | 0 - 7 |
| | | 1385 | Subsurface | 3000 | | 11800 | 2040 | 2680 | 74000 | 2400 | 16840 | 7 - 18 |
| | | 1386 | Subsoil | 11340 | | 11880 | 2040 | 4500 | 107820 | 3840 | 28620 | 20 - 40 |

Illinois Soil Type No. 335: Lower Illinoisan Glaciation; Yellow Silt Loam; Rolling Timber Land. Results Are Given as Pounds Per Acre in 2 Million Pounds of Surface Soil (About 0-7 Inches), in 4 Million Pounds of Subsurface (About 7-20 Inches), and in 6 Million Pounds of Subsoil (About 20-40 Inches)

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| N.E., N.W., N.W., 24, 9 S., 2 W. 3rd P.M. | Jackson | 897 | Surface | 80 | | 18640 | 1820 | 940 | 32760 | 700 | 5600 | 0 - 7 |
| | | 898 | Subsurface | 7320 | | 14520 | 1600 | 2200 | 70200 | 1560 | 14560 | 7 - 22 |
| | | 899 | Subsoil | 25080 | | 14760 | 1860 | 3960 | 106320 | 3000 | 29160 | 23 - 40 |
| S.W., S.E., S.W., 24, 3 S., 3 E. 3rd P.M. | Jefferson | 1148 | Surface | 1020 | | 27440 | 2440 | 940 | 24480 | 660 | 3560 | 0 - 7 |
| | | 1149 | Subsurface | 7640 | | 22600 | 2560 | 2120 | 52840 | 1080 | 8760 | 7 - 22 |
| | | 1150 | Subsoil | 30840 | | 16560 | 2940 | 2580 | 86280 | 2100 | 25920 | 22 - 40 |
| S.E., N.W., N.E., 12, 8 S., 1 E. 3rd P.M. | Williamson | 1952 | Surface | 80 | | 27300 | 1880 | 1160 | 33360 | 1020 | 7660 | 0 - 7 |
| | | 1953 | Subsurface | 10520 | | 24960 | 1680 | 2080 | 73280 | 1680 | 16960 | 7 - 16 |
| | | 1954 | Subsoil | 40980 | | 33300 | 2640 | 3900 | 106560 | 2400 | 29340 | 18 - 40 |
| S.W., N.E., S.E., 33, 7 N., 2 W. 3rd P.M. | Bond | 1980 | Surface | 80 | | 25320 | 2500 | 1000 | 36860 | 820 | 6380 | 0 - 7 |
| | | 1981 | Subsurface | 2080 | | 16480 | 2360 | 2000 | 76480 | 1720 | 15440 | 7 - 16 |
| | | 1982 | Subsoil | 20880 | | 13680 | 2400 | 3300 | 99660 | 2580 | 29580 | 18 - 40 |
| N.W., N.W., N.E., 32, 2 N., 3 W. 3rd P.M. | Clinton | 2322 | Surface | 300 | | 22860 | 2640 | 780 | 32160 | 660 | 7980 | 0 - 7 |
| | | 2324 | Subsurface | 5080 | | 22240 | 3080 | 1680 | 65120 | 1440 | 19240 | 7 - 16 |
| | | 2325 | Subsoil | 4560 | | 19080 | 3240 | 2400 | 99480 | 2100 | 28980 | 18 - 40 |
| N.W., N.E., N.E., 8, 3 S., 6 W. 3rd P.M. | St. Clair | 2604 | Surface | 280 | | 18740 | 1600 | 860 | 31480 | 780 | 6460 | 0 - 7 |
| | | 2605 | Subsurface | 7120 | | 15680 | 1720 | 1920 | 66360 | 1600 | 18160 | 7 - 16 |
| | | 2606 | Subsoil | 6720 | | 13980 | 1800 | 2880 | 99720 | 2460 | 25980 | 18 - 40 |

ILLINOIS SOIL TYPE No. 435: MIDDLE ILLINOISAN GLACIATION; YELLOW SILT LOAM; ROLLING TIMBER LAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.E., S.E., S.E., 32, | | 829 | Surface | 40 | | 17960 | 1760 | 840 | 31340 | 640 | 4800 | 0 - 7 |
| 10 N., 7 W. 3rd P.M. | Macoupin | 830 | Subsurface | 280 | | 16120 | 1800 | 1560 | 58880 | 1240 | 11920 | 7 - 17 |
| | | 831 | Subsoil | 1200 | | 20640 | 2520 | 2640 | 88560 | 2280 | 28320 | 19 - 40 |
| S.E., S.E., S.W., 4, | | 995 | Surface | 20 | | 22140 | 2000 | 860 | 35580 | 840 | 5740 | 0 - 7 |
| 16 N., 5 W. 3rd P.M. | Sangamon | 996 | Subsurface | 200 | | 14520 | 1920 | 1880 | 70120 | 1680 | 15440 | 7 - 16 |
| | | 997 | Subsoil | 9420 | | 15060 | 2340 | 3660 | 104220 | 3600 | 31560 | 18 - 40 |
| N.W., N.E., S.W., 18, | | 998 | Surface | 60 | | 21240 | 1840 | 840 | 33940 | 700 | 4600 | 0 - 7 |
| 15 N., 4 W. 3rd P.M. | Sangamon | 999 | Subsurface | 80 | | 18880 | 2160 | 1320 | 68040 | 1280 | 12680 | 7 - 16 |
| | | 1000 | Subsoil | 60 | | 20400 | 3120 | 2700 | 102480 | 2520 | 33540 | 18 - 40 |
| N.W., N.E., N.E., 5, | | 1001 | Surface | 20 | | 19040 | 1880 | 720 | 33000 | 700 | 5260 | 0 - 7 |
| 14 N., 4 W. 3rd P.M. | Sangamon | 1002 | Subsurface | 920 | | 12000 | 2040 | 1280 | 64440 | 1240 | 14200 | 7 - 16 |
| | | 1003 | Subsoil | 4140 | | 28500 | 3300 | 2220 | 100740 | 2160 | 32100 | 18 - 40 |

Illinois Soil Type No. 535: Upper Illinoisan Glaciation; Yellow Silt Loam; Rolling Timber Land. Results Are Given as Pounds Per Acre in 2 Million Pounds of Surface Soil (About 0-7 Inches), in 4 Million Pounds of Subsurface (About 7-20 Inches), and in 6 Million Pounds of Subsoil (About 20-40 Inches)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S., S.W., S.E., 27, 1 S., 8 W. 4th P.M. | Adams | 795 | Surface | 200 | | 11020 | 1320 | 600 | 34880 | 500 | 5040 | 0 - 7 |
| | | 796 | Subsurface | 2280 | | 8280 | 1760 | 1400 | 72680 | 1240 | 12680 | 7 - 14 |
| | | 797 | Subsoil | 11040 | | 9540 | 1980 | 3060 | 105240 | 2880 | 27480 | 16 - 40 |
| S.E., S.W., N.E., 15, 11 N., 2 E. 4th P.M. | Knox | 1107 | Surface | 80 | | 19520 | 2020 | 1040 | 35360 | 880 | 5880 | 0 - 7 |
| | | 1108 | Subsurface | 2000 | | 10320 | 1920 | 1840 | 73720 | 1920 | 13120 | 7 - 16 |
| | | 1109 | Subsoil | 9000 | | 10920 | 2400 | 3360 | 98100 | 3120 | 32640 | 18 - 40 |
| S.W., S.E., S.W., 18, 10 N., 2 E. 4th P.M. | Knox | 1110 | Surface | 60 | | 22680 | 2380 | 920 | 36620 | 800 | 6440 | 0 - 7 |
| | | 1111 | Subsurface | 200 | | 11160 | 2160 | 1640 | 73000 | 1440 | 15520 | 7 - 16 |
| | | 1112 | Subsoil | 4500 | | 10560 | 2220 | 3420 | 105540 | 2820 | 32880 | 18 - 40 |
| S.W., S.W., S.E., 26, 12 N., 3 E. 4th P.M. | Knox | 1119 | Surface | 180 | | 24200 | 2320 | 780 | 32580 | 780 | 5200 | 0 - 7 |
| | | 1120 | Subsurface | 4400 | | 11080 | 1760 | 1560 | 70880 | 1400 | 14960 | 7 - 14 |
| | | 1121 | Subsoil | 300 | | 13140 | 2520 | 3240 | 94920 | 3120 | 34380 | 16 - 40 |

ILLINOIS SOIL TYPE No. 635: PRE-IOWAN GLACIATION; YELLOW SILT LOAM; ROLLING TIMBER LAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| S.E., S.W., N.W., 35, 29 N., 10 E. 4th P.M. | Winnebago | 1205 | Surface | 60 | | 21040 | 2180 | 820 | 38160 | 800 | 5640 | 0 - 7 |
| | | 1206 | Subsurface | 1200 | | 17880 | 2320 | 1680 | 76520 | 1640 | 15720 | 7 - 16 |
| | | 1207 | Subsoil | 4560 | | 17400 | 2520 | 3120 | 104400 | 3180 | 25800 | 18 - 40 |
| S.E., S.E., N.E., 1, 28 N., 10 E. 4th P.M. | Winnebago | 1208 | Surface | 20 | | 26980 | 2540 | 840 | 36660 | 760 | 6260 | 0 - 7 |
| | | 1209 | Subsurface | 40 | | 15800 | 2280 | 1560 | 76760 | 1520 | 16320 | 7 - 16 |
| | | 1210 | Subsoil | 2520 | | 13140 | 2220 | 3240 | 100320 | 3360 | 27720 | 18 - 40 |
| S.E., S.E., N.W., 36, 26 N., 11 E. 4th P.M. | Winnebago | 1211 | Surface | 20 | | 26620 | 2460 | 880 | 36720 | 900 | 5360 | 0 - 7 |
| | | 1212 | Subsurface | 720 | | 17560 | 2280 | 2000 | 75160 | 1720 | 15160 | 7 - 16 |
| | | 1213 | Subsoil | 9360 | | 16080 | 2400 | 3840 | 101580 | 3720 | 28860 | 18 - 40 |

ILLINOIS SOIL TYPE No. 735: IOWAN GLACIATION; YELLOW SILT LOAM; ROLLING TIMBER LAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES).

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| N.E., N.W., N.W., 21, 43 N., 2 E. 3rd P.M. | Winnebago | 1214 | Surface | 40 | | 18480 | 1800 | 1000 | 35280 | 920 | 5340 | 0 - 7 |
| | | 1215 | Subsurface | 2360 | | 12080 | 1800 | 2200 | 70040 | 1720 | 17040 | 7 - 16 |
| | | 1216 | Subsoil | 5880 | | 10860 | 2100 | 3720 | 103320 | 3300 | 27840 | 18 - 40 |
| S.E., N.E., S.E., 12, 46 N., 2 E. 3rd P.M. | Winnebago | 1217 | Surface | 20 | | 21300 | 2020 | 820 | 36280 | 640 | 6340 | 0 - 7 |
| | | 1218 | Subsurface | 640 | | 17840 | 2440 | 1720 | 72320 | 1560 | 16640 | 7 - 16 |
| | | 1219 | Subsoil | 1620 | | 13320 | 2880 | 4080 | 106740 | 3900 | 30180 | 18 - 40 |

ILLINOIS SOIL TYPE NO. 1135: EARLY WISCONSIN GLACIATION; YELLOW SILT LOAM; ROLLING TIMBER LAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.W., N.W., N.E., 35, 22 N., 2 E. 3rd P.M. | McLean | 1271 | Surface | 100 | | 21020 | 1780 | 780 | 31960 | 760 | 5500 | 0 - 7 |
| | | 1272 | Subsurface | 5760 | | 15520 | 1920 | 1440 | 66600 | 1360 | 16520 | 7 - 16 |
| | | 1273 | Subsoil | | 260000 | 19440 | 2460 | 3180 | 98880 | 2820 | 39240 | 18 - 40 |
| S.W., S.E., N.W., 20, 14 N., 10 W. 2nd P.M. | Edgar | 1478 | Surface | 40 | | 19720 | 1880 | 960 | 31640 | 740 | 4860 | 0 - 7 |
| | | 1479 | Subsurface | 520 | | 14560 | 1960 | 1600 | 65920 | 1000 | 13360 | 7 - 16 |
| | | 1480 | Subsoil | 120 | | 19920 | 2640 | 2880 | 108660 | 2160 | 29400 | 18 - 40 |
| N.E., N.W., S.W., 24, 13 N., 11 W. 3rd P.M. | Edgar | 1484 | Surface | 120 | | 20020 | 2000 | 800 | 30620 | 760 | 5280 | 0 - 7 |
| | | 1485 | Subsurface | 8040 | | 12880 | 2120 | 1280 | 67440 | 1080 | 14200 | 7 - 16 |
| | | 1486 | Subsoil | 12660 | | 13800 | 2400 | 1860 | 113640 | 1860 | 28440 | 18 - 40 |
| S.E., N.W., N.W., 33, 26 N., 3 W. 3rd P.M. | Tazewell | 1511 | Surface | 20 | | 22200 | 1820 | 880 | 33840 | 700 | 5060 | 0 - 7 |
| | | 1512 | Subsurface | 2680 | | 15160 | 2120 | 1760 | 71880 | 1320 | 16360 | 7 - 14 |
| | | 1513 | Subsoil | 480 | | 18960 | 2820 | 2940 | 101940 | 2760 | 32280 | 16 - 40 |
| N.W., N.W., N.W., 14, 24 N., 2 W. 3rd P.M. | Tazewell | 1523 | Surface | 20 | | 21220 | 1820 | 840 | 35180 | 860 | 6080 | 0 - 7 |
| | | 1524 | Subsurface | 1560 | | 10640 | 1680 | 1720 | 70920 | 1480 | 16160 | 7 - 14 |
| | | 1525 | Subsoil | 2700 | | 20160 | 2340 | 2580 | 97860 | 2520 | 32700 | 16 - 40 |
| N.W., S.W., N.W., 14, 23 N., 3 W. 3rd P.M. | Tazewell | 1526 | Surface | 60 | | 25620 | 2060 | 960 | 33060 | 960 | 5140 | 0 - 7 |
| | | 1527 | Subsurface | 4920 | | 9400 | 1400 | 1720 | 69400 | 1640 | 13800 | 7 - 14 |
| | | 1528 | Subsoil | 6060 | | 12240 | 2040 | 2520 | 102000 | 1920 | 32700 | 16 - 40 |

ILLINOIS SOIL TYPE No. 864: DEEP LOESS AREA; YELLOW FINE SANDY LOAM; ROLLING TIMBER LAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.W., S.W., S.W., 12, 1 N., 9 W. 3rd P.M. | St. Clair | 732 | Surface | 140 | | 19140 | 1720 | 940 | 36340 | 620 | 5600 | 0 - 7 |
| | | 733 | Subsurface | 80 | | 28240 | 2560 | 1320 | 69280 | 1160 | 12560 | 7 - 14 |
| | | 734 | Subsoil | 720 | | 14520 | 2580 | 3000 | 93120 | 2700 | 28980 | 15 - 40 |
| S.W., S.W., S.E., 23, 1 N., 10 W. 3rd P.M. | St. Clair | 735 | Surface | 40 | | 16660 | 1700 | 920 | 34960 | 760 | 5900 | 0 - 7 |
| | | 736 | Subsurface | 80 | | 13000 | 2000 | 1720 | 72920 | 1680 | 14400 | 7 - 17 |
| | | 737 | Subsoil | 4380 | | 9960 | 2640 | 4200 | 108480 | 4380 | 32700 | 20 - 40 |
| N.W., 16, 2 N., 8 W. 3rd P.M. | St. Clair | 738 | Surface | 20 | | 26620 | 2140 | 1120 | 33220 | 780 | 5660 | 0 - 7 |
| | | 739 | Subsurface | | 10330 | 28360 | 2680 | 1640 | 65080 | 1480 | 11880 | 7 - 16 |
| | | 740 | Subsoil | | 3000 | 10500 | 2400 | 3120 | 104700 | 2940 | 29040 | 18 - 40 |
| N.W., S.E., S.W., 21, 1 S., 8 W. 4th P.M. | Adams | 792 | Surface | 80 | | 27120 | 2520 | 920 | 34180 | 920 | 5660 | 0 - 7 |
| | | 793 | Subsurface | 160 | | 42920 | 4200 | 1640 | 70360 | 1680 | 12720 | 7 - 16 |
| | | 794 | Subsoil | 540 | | 19260 | 2940 | 3000 | 94980 | 3000 | 28860 | 18 - 40 |
| N.W., N.W., N.W., 2, 9 N., 2 W. 3rd P.M. | Montgomery | 1769 | Surface | 20 | | 31580 | 2680 | 920 | 36760 | 780 | 7360 | 0 - 7 |
| | | 1770 | Subsurface | 4480 | | 20720 | 2680 | 1440 | 71560 | 1280 | 19840 | 7 - 16 |
| | | 1771 | Subsoil | 8880 | | 18900 | 2820 | 2220 | 102420 | 1740 | 24660 | 18 - 40 |
| S.E., S.W., S.W., 22, 8 N., 4 W. 3rd P.M. | Montgomery | 1772 | Surface | 20 | | 24800 | 2740 | 1120 | 37120 | 1020 | 6720 | 0 - 7 |
| | | 1773 | Subsurface | 200 | | 23040 | 2920 | 1920 | 73640 | 1880 | 16880 | 7 - 17 |
| | | 1774 | Subsoil | 1800 | | 26760 | 3660 | 3420 | 109800 | 3120 | 32340 | 17 - 40 |
| S.W., S.W., S.E., 10, 9 N., 4 W. 3rd P.M. | Montgomery | 1775 | Surface | | 1670 | 38200 | 3480 | 1020 | 34340 | 840 | 7180 | 0 - 7 |
| | | 1776 | Subsurface | 80 | | 33960 | 3440 | 1600 | 69680 | 1440 | 17240 | 7 - 17 |
| | | 1777 | Subsoil | 360 | | 24360 | 3120 | 2460 | 103380 | 1980 | 32580 | 17 - 40 |

ILLINOIS SOIL TYPE NO. 864: DEEP LOESS AREA; YELLOW FINE SANDY LOAM; ROLLING TIMBER LAND.

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.E., N.W., N.W., 6, 1 S., 9 W. 3rd P.M. | St. Clair | 2544 | Surface | 100 | | 14260 | 1280 | 800 | 36460 | 600 | 5600 | 0 - 7 |
| | | 2545 | Subsurface | 1400 | | 12080 | 1520 | 1640 | 75840 | 1640 | 14200 | 7 - 18 |
| | | 2546 | Subsoil | 6960 | | 14280 | 2160 | 3840 | 111600 | 3420 | 33540 | 20 - 40 |
| N.W., N.W., N.W., 2, 1 S., 10 W. 3rd P.M. | St. Clair | 2547 | Surface | 60 | | 12820 | 1280 | 880 | 37380 | 720 | 5600 | 0 - 7 |
| | | 2548 | Subsurface | 120 | | 9200 | 1480 | 1520 | 77480 | 1480 | 14160 | 7 - 18 |
| | | 2549 | Subsoil | 5340 | | 14460 | 2280 | 4620 | 118380 | 3900 | 33180 | 20 - 40 |

ILLINOIS SOIL TYPE NO. 1034: LATE WISCONSIN GLACIATION; YELLOW-GRAY SILT LOAM; UNDULATING TIMBER LAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N.W., S.W., N.E., 22, 46 N., 10 E. 3rd P.M. | Lake | 576 | Surface | 40 | | 35440 | 3120 | 860 | 45660 | 880 | 5960 | 0 - 6 |
| | | 577 | Subsurface | 120 | | 17760 | 2040 | 1600 | 98800 | 1280 | 21560 | 6 - 18 |
| | | 578 | Subsoil | | 577000 | 27480 | 3180 | 1680 | 149580 | 1560 | 58380 | 18 - 42 |
| S.W., S.W., N.W., 29, 46 N., 12 E. 3rd P.M. | Lake | 1697 | Surface | 80 | | 35940 | 3000 | 820 | 48080 | 800 | 8460 | 0 - 7 |
| | | 1698 | Subsurface | 1080 | | 20120 | 2400 | 1080 | 112000 | 1000 | 32120 | 7 - 16 |
| | | 1699 | Subsoil | | 1139000 | 21720 | 2820 | 2400 | 156600 | 2400 | 57360 | 18 - 40 |
| N.W., N.E., S.E., 18, 43 N., 12 E. 3rd P.M. | Lake | 1700 | Surface | 20 | | 30860 | 2820 | 900 | 46320 | 920 | 8560 | 0 - 7 |
| | | 1701 | Subsurface | 120 | | 28400 | 2840 | 1320 | 115800 | 1280 | 37800 | 7 - 16 |
| | | 1702 | Subsoil | | 1008500 | 29100 | 3420 | 2880 | 178800 | 2760 | 73440 | 18 - 40 |
| N.W., S.E., S.E., 11, 44 N., 9 E. 3rd P.M. | Lake | 1706 | Surface | 20 | | 30060 | 2600 | 660 | 50360 | 640 | 13560 | 0 - 7 |
| | | 1707 | Subsurface | 40 | | 37880 | 3560 | 1560 | 117800 | 1440 | 46800 | 7 - 16 |
| | | 1708 | Subsoil | | 1412500 | 33780 | 3540 | 2640 | 141960 | 2520 | 59400 | 18 - 40 |

ILLINOIS SOIL TYPE No. 760: IOWAN GLACIATION; BROWN SANDY LOAM; UNDULATING UPLAND. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.E., N.W., N.E., 34, 27 N., 10 E. 4th P.M. | Winnebago | 1187 | Surface | 80 | | 35440 | 3080 | 940 | 24580 | 800 | 4640 | 0 - 7 |
| | | 1188 | Subsurface | 480 | | 51520 | 4680 | 1560 | 53120 | 1400 | 10560 | 7 - 16 |
| | | 1189 | Subsoil | 720 | | 26160 | 4080 | 2220 | 69660 | 2040 | 16440 | 16 - 36 |
| S.E., N.E., S.E., 32, 27 N., 11 E. 4th, P.M. | Winnebago | 1190 | Surface | 180 | | 28160 | 2780 | 660 | 29580 | 600 | 5840 | 0 - 7 |
| | | 1191 | Subsurface | 1240 | | 49840 | 4520 | 1280 | 57320 | 1160 | 13120 | 7 - 16 |
| | | 1192 | Subsoil | | 68000 | 40680 | 3180 | 1740 | 89640 | 1440 | 22140 | 18 - 36<br>18 - 38 |
| S.W., S.W., N.W., 7, 43 N., 2 E. 3rd P.M. | Winnebago | 1193 | Surface | 80 | | 28020 | 2380 | 580 | 28720 | 520 | 4540 | 0 - 7 |
| | | 1194 | Subsurface | 1120 | | 48280 | 3800 | 1160 | 57960 | 1080 | 11560 | 7 - 16 |
| | | 1195 | Subsoil | | 47500 | 35220 | 3660 | 1740 | 99360 | 1680 | 21300 | 18 - 40 |
| N.E., S.E., S.E., 26, 46 N., 1 E. 3rd P.M. | Winnebago | 1199 | Surface | 60 | | 45620 | 3880 | 1120 | 21640 | 1060 | 5560 | 0 - 7 |
| | | 1200 | Subsurface | 40 | | 66960 | 6160 | 2320 | 43240 | 2040 | 12440 | 7 - 16 |
| | | 1201 | Subsoil | | 136500 | 69060 | 6720 | 4380 | 61380 | 3960 | 24240 | 18 - 30 |
| N.E., S.W., S.W., 34, 45 N., 1 E. 3rd P.M. | Winnebago | 1202 | Surface | 100 | | 40060 | 3240 | 960 | 28960 | 860 | 4980 | 0 - 7 |
| | | 1203 | Subsurface | 240 | | 49120 | 4360 | 1640 | 59880 | 1560 | 11240 | 7 - 16 |
| | | 1204 | Subsoil | 420 | | 29880 | 3180 | 2100 | 85860 | 2100 | 18120 | 18 - 40 |

ILLINOIS SOIL TYPE NO. 1331: OLD BOTTOM LANDS; DEEP GRAY SILT LOAM. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| N.W., N.E., 21, 2 S., 7 W. 3rd P.M. | St. Clair | 759 | Surface | 640 | | 34300 | 2920 | 1480 | 34660 | 1260 | 4960 | 0 - 6 |
| | | 760 | Subsurface | 7280 | | 27800 | 2400 | 1960 | 70480 | 1600 | 9000 | 6 - 20 |
| | | 761 | Subsoil | 17220 | | 27840 | 2640 | 2820 | 97860 | 2040 | 17760 | 20 - 40 |
| S.E., N.W., S.W., 14, 4 N., 6 E. 3rd P.M. | Clay | 870 | Surface | 120 | | 46480 | 3860 | 1640 | 34920 | 1480 | 7080 | 0 - 7 |
| | | 871 | Subsurface | 2600 | | 22800 | 2320 | 2080 | 68840 | 2160 | 11920 | 7 - 20 |
| | | 872 | Subsoil | 8280 | | 26040 | 2100 | 2700 | 103440 | 2760 | 19860 | 20 - 40 |
| S.W., S.W., S.E., 32, 1 N., 13 W. 2nd P.M. | Wabash | 882 | Surface | 1500 | | 33700 | 3280 | 1160 | 28860 | 940 | 4940 | 0 - 7 |
| | | 883 | Subsurface | 6960 | | 17080 | 1840 | 1080 | 63240 | 1000 | 9920 | 7 - 20 |
| | | 884 | Subsoil | 6900 | | 20460 | 2280 | 2220 | 97140 | 1740 | 19380 | 20 - 40<br>30 - 40 |
| S.W., S.W., S.W., 17, 9 S., 1 W. 3rd P.M. | Jackson | 894 | Surface | 300 | | 20600 | 2080 | 1100 | 34820 | 880 | 5280 | 0 - 7 |
| | | 895 | Subsurface | 5200 | | 20440 | 2240 | 1800 | 70320 | 1480 | 11920 | 7 - 20 |
| | | 896 | Subsoil | 10800 | | 16920 | 2340 | 2520 | 106140 | 1740 | 20100 | 20 - 40 |
| N.W., N.E., N.E., 18, 3 N., 8 E. 3rd P.M. | Clay | 903 | Surface | 80 | | 16620 | 1760 | 1400 | 36500 | 1260 | 6620 | 0 - 7 |
| | | 904 | Subsurface | 1720 | | 22760 | 2560 | 2840 | 74720 | 2640 | 16400 | 7 - 20 |
| | | 905 | Subsoil | 2520 | | 18540 | 2520 | 3840 | 111960 | 3300 | 25380 | 20 - 40 |
| S.E., S.E., N.E., 26, 2 N., 2 E. 3rd P.M. | Marion | 1154 | Surface | 20 | | 23700 | 2360 | 800 | 30360 | 700 | 4140 | 0 - 7 |
| | | 1155 | Subsurface | 3200 | | 14760 | 2120 | 1240 | 60960 | 1000 | 7600 | 7 - 24 |
| | | 1156 | Subsoil | 8640 | | 10380 | 1800 | 1620 | 93120 | 1260 | 13320 | 24 - 40 |

ILLINOIS SOIL TYPE No. 1451: LATE BOTTOM LANDS; BROWN LOAM. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 4 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 6 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| N.W., S.E., S.E., 16 N., 1 W. 3rd P.M. | Sangamon | 586 | Surface | 140 | | 50000 | 4820 | 1540 | 38700 | 1460 | 9860 | 0 - 6 |
| | | 587 | Subsurface | 240 | | 74280 | 7200 | 2280 | 71240 | 2000 | 18200 | 6 - 18 |
| | | 588 | Subsoil | 420 | | 46800 | 5100 | 2280 | 108720 | 2040 | 25800 | 18 - 40 |
| N.W., N.E., N.W., 16 N., 1 W. 3rd P.M. | Macon | 589 | Surface | | 1500 | 56900 | 5480 | 1400 | 40440 | 1320 | 11040 | 0 - 6 |
| | | 590 | Subsurface | | 2000 | 87280 | 8240 | 2040 | 82880 | 1920 | 21800 | 6 - 18 |
| | | 591 | Subsoil | | 2500 | 49500 | 4920 | 2280 | 142140 | 1920 | 31920 | 18 - 42 |
| S.W., N.W., N.W., 25, 24 N., 6 W. 3rd P.M. | Tazewell | 632 | Surface | | 8170 | 60080 | 4940 | 2120 | 42720 | 1800 | 11020 | 0 - 7 |
| | | 633 | Subsurface | | 3330 | 84640 | 8000 | 2720 | 84360 | 2200 | 21600 | 7 - 18 |
| | | 634 | Subsoil | | 21500 | 48900 | 4500 | 2880 | 132840 | 2340 | 33480 | 20 - 40 |
| N.W., S.W., S.W., 28, 4 N., 9 W. 4th P.M. | Hancock | 798 | Surface | | 1170 | 39600 | 3440 | 1280 | 33260 | 1200 | 7000 | 0 - 7 |
| | | 799 | Subsurface | 120 | | 40440 | 3600 | 1400 | 64200 | 1280 | 11760 | 7 - 20 |
| | | 800 | Subsoil | 420 | | 15420 | 1620 | 1860 | 88080 | 1740 | 12780 | 22 - 40 |
| N.E., S.E., N.E., 34, 16 N., 2 W. 3rd P.M. | Sangamon | 1013 | Surface | 240 | | 62140 | 4920 | 1740 | 44720 | 1520 | 9000 | 0 - 7 |
| | | 1014 | Subsurface | 80 | | 72800 | 6280 | 2360 | 85000 | 1920 | 26680 | 7 - 20 |
| | | 1015 | Subsoil | 60 | | 57360 | 4620 | 2760 | 125820 | 2160 | 16620 | 22 - 40 |

ILLINOIS SOIL TYPE NO. 1481: SAND AREAS; SAND SOIL. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 2½ MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 5 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 7½ MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Lime-stone re-quired. | Lime-stone pres-ent. | Total organic carbon. | Total nitro-gen. | Total phos-phorus. | Total potas-sium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phos-phorus. | Potas-sium. | |
| N.W., N.E., N.E., 4, 22 N., 5 W. 3rd P.M. | Tazewell | 529 | Surface | 700 | | 4900 | 1400 | 730 | 29380 | 480 | 3000 | 0 - 7 |
| N.W., N.W., S.E., 20, 24 N., 5 W. 3rd P.M. | Tazewell | 615 | Surface | 30 | | 9600 | 1230 | 580 | 39830 | 580 | 4050 | 0 - 6 |
| | | 616 | Subsurface | 50 | | 18810 | 2900 | 1500 | 80760 | 1202 | 7760 | 6 - 40 |
| | | 616 | Subsoil | 80 | | 28200 | 4350 | 2250 | 121130 | 1800 | 11630 | 6 - 40 |
| N.W., S.E., N.W., 10, 29 N., 11 W., 2nd P.M. | Kankakee | 1131 | Surface | 30 | | 11500 | 1130 | 930 | 33450 | 830 | 2950 | 0 - 7 |
| | | 1132 | Subsurface | 50 | | 8400 | 700 | 1650 | 68200 | 1700 | 5960 | 7 - 40 |
| | | 1132 | Subsoil | 80 | | 12600 | 1050 | 2480 | 102300 | 2550 | 8930 | 7 - 40 |
| N.W., N.E., S.W., 15 46 N., 1 E. 3rd P.M. | Winnebago | 1168 | Surface | 30 | | 21400 | 2000 | 1030 | 20850 | 880 | 3530 | 0 - 7 |
| | | 1169 | Subsurface | 50 | | 12600 | 2600 | 1300 | 39110 | 900 | 6800 | 7 - 40 |
| | | 1169 | Subsoil | 80 | | 18900 | 3900 | 1950 | 58650 | 1350 | 10200 | 7 - 40 |

ILLINOIS SOIL TYPE No. 1401: SWAMP AREA; DEEP PEAT. RESULTS ARE GIVEN AS POUNDS PER ACRE IN 1 MILLION POUNDS OF SURFACE SOIL (ABOUT 0-7 INCHES), IN 2 MILLION POUNDS OF SUBSURFACE (ABOUT 7-20 INCHES), AND IN 3 MILLION POUNDS OF SUBSOIL (ABOUT 20-40 INCHES)

| Location. | | Soil No. | Soil stratum. | Limestone required. | Limestone present. | Total organic carbon. | Total nitrogen. | Total phosphorus. | Total potassium. | Acid-soluble. | | Stratum sampled. (Inches.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| By land survey. | By county. | | | | | | | | | Phosphorus. | Potassium. | |
| S.W., N.W., N.E., 21, 23 N., 6 W. 3rd P.M. | Mason | 549 | Surface | 230 | | 475720 | 33720 | 1840 | 3090 | 1610 | 1100 | 0 - 7 |
| | | 550 | Subsurface | 300 | | 875840 | 63920 | 2340 | 5600 | 2280 | 2800 | 7 - 18 |
| | | 551 | Subsoil | 390 | | 1335960 | 84960 | 2820 | 12360 | 2160 | 4200 | 18 - 42 |
| S.E., N.E., N.W., 5, 23 N., 1 W., 3rd P.M. | McLean | 1328 | Surface | | 5833 | 341850 | 32190 | 2530 | 4910* | 2460 | 1500 | 0 - 7 |
| | | 1329 | Subsurface | | 3833 | 647900 | 56900 | 4260 | 12460* | 4280 | 3460 | 7 - 20 |
| N.E., N.W., N.W., 14, 46 N., 9 E. 3rd P.M. | Lake | 1669 | Surface | 70 | | 437320 | 34020 | 1610 | 3000 | 1320 | 1730 | 0 - 7 |
| | | 1670 | Subsurface | 240 | | 861800 | 70030 | 3080 | 7980 | 2420 | 4300 | 7 - 40 |
| | | 1670 | Subsoil | 360 | | 1292460 | 105000 | 4620 | 11970 | 3630 | 6450 | 7 - 40 |
| S.W., N.W., N.W., 35, 46 N., 9 E. 3rd P.M. | Lake | 1671 | Surface | 100 | | 402600 | 37980 | 2050 | 2880 | 1350 | 1840 | 0 - 7 |
| | | 1672 | Subsurface | 60 | | 744000 | 66370 | 3000 | 9040 | 2500 | 4680 | 7 - 40 |
| | | 1672 | Subsoil | 90 | | 1115760 | 99510 | 4500 | 13560 | 3750 | 7020 | 7 - 40 |
| S. 10, N.E., N.E., 22, 23 N., 7 W. 3rd P.M. | Mason | 1848 | Surface | 110 | | 378920 | 36470 | 1790 | 2760 | 1630 | 1740 | 0 - 7 |
| | | 1849 | Subsurface | 220 | | 833800 | 67660 | 2000 | 5420 | 1940 | 3300 | 7 - 40 |
| | | 1849 | Subsoil | 330 | | 1250100 | 101460 | 3000 | 8130 | 2910 | 4950 | 7 - 40 |

*Not included in general average because the area is small and surrounded by soils rich in potassium.

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